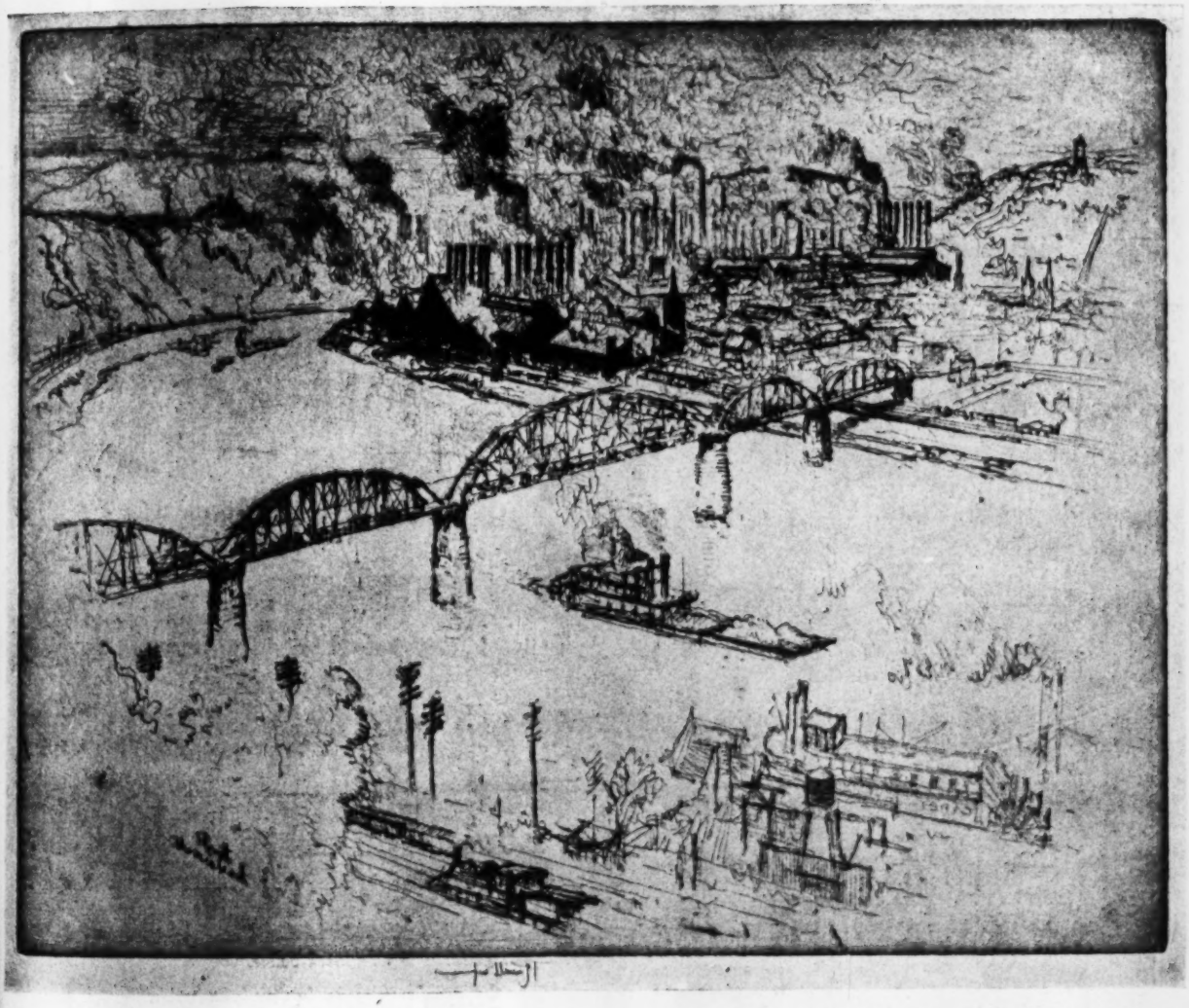
AUG 6 1921

# Engineering News-Record

Devoted to Civil Engineering and Contracting

McGraw-Hill Company, Inc.

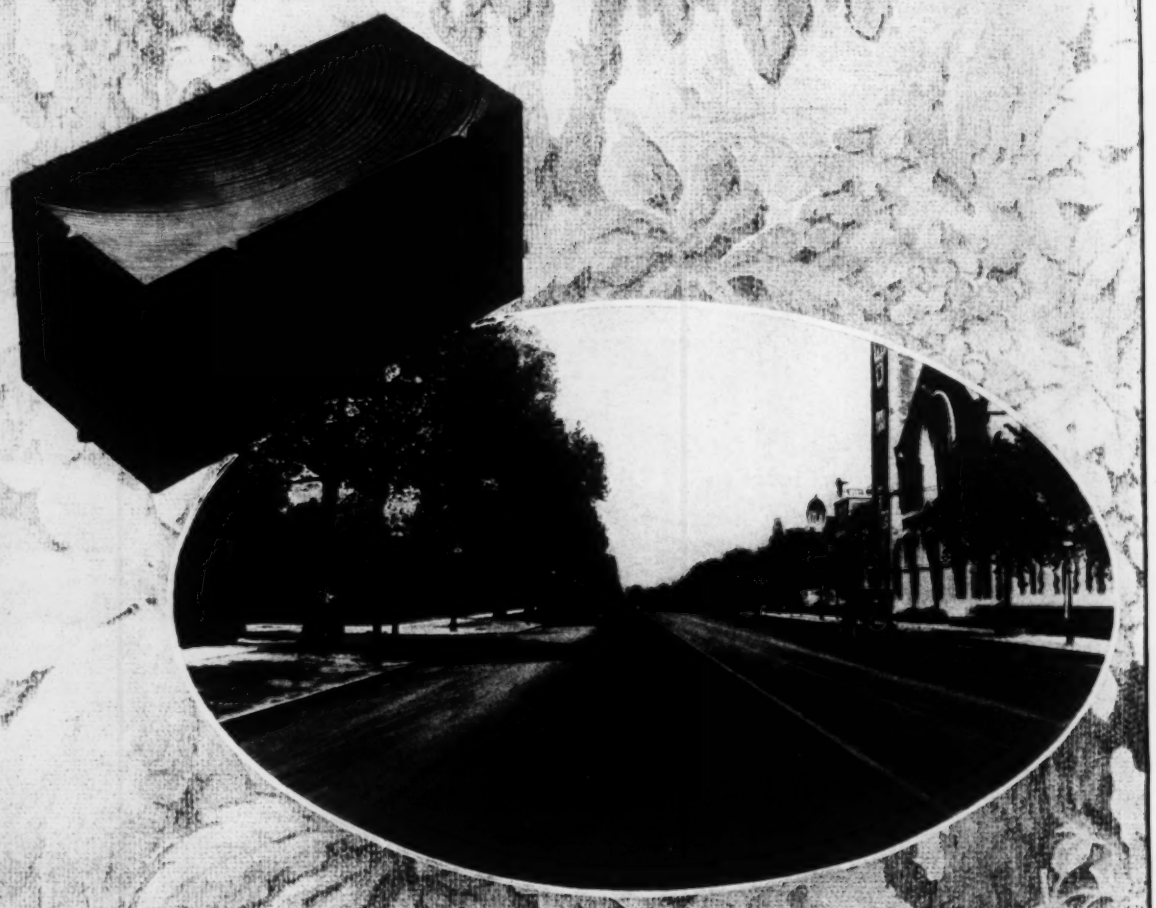
**August 4, 1921**



Homestead from Across the Monongahela
By Joseph Pennell

# KREOLITE LUG WOOD BLOCKS

"The Paving that's Saving"



## Union Avenue, St. Louis, Missouri

Kreolite Lug Wood Blocks have won recognition for exceptional endurance under every known kind of traffic.

Kreolite Pavements are strong as a unit—made so by their patented lug construction, which allows the Kreolite Filler to penetrate to the base of the blocks.

The lugs on the blocks provide ample room for expansion, preventing any buckling or bleeding and also offer a foothold for horses.

The Lugs make a good block better.

Write the Toledo Office for further information on Kreolite Lug Wood Block Pavements.

**The Jennison-Wright Company, 79 Kreolite Building, Toledo, Ohio**

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—James H. McGraw, President

# ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. Mehren, Editor

Volume 87 — NEW YORK, AUGUST 4, 1921 — Number 5

## Art and the Engineer

TO CONFOUND those aesthetes who see only dirt and grubbiness and raw utility in what the engineer does, there are artists like Jonas Lie and Joseph Pennell who find their inspiration in the useful works of man. And though engineers are the most practical of men there are few among them who do not respond to such artistic appreciation of the things they build and of the way they build them. While the worship of the beautiful can profitably be made the major interest of life only by a minority of the world, no one likes to think that incident to his day's work he is adding to the altogether too great ugliness of things in general. In his secret heart, then, the engineer takes pride in such sketches as the one that graces our cover this week because it is evidence that a master eye sees in what is a distinctly engineering achievement enough of beauty to put to its perpetuation the skill of a master hand.

## Centralizing State Engineering Work

THE transfer on July 1 of "strictly engineering work" from the New York state departments of health and of conservation to the office of state engineer, noted on p. 207, is a step in the centralization of state engineering work the results of which should be worth observing. One feature of the new legislation that demands careful watching of results is having plans for water supply and sewerage projects go to the state engineer for examination and report while the issuing of permits will continue to rest with the commissioners of conservation and health. This seems likely to result in divided responsibility, with possible duplication on the one hand or of inefficiency on the other. It will afford a chance for conflict in either case, or else make the two commissioners mere rubber stamps. The danger of conflict or of inefficiency is one of the future rather than the present, since there has been a transfer of personnel as well as of duties, but that presents no safeguard for the future and has no bearing upon broad questions of state administrative organization.

## Dividing Engineering and Sanitation

THE changes at Albany mentioned in the foregoing note seem to be based on the assumption that sanitary engineering work can be divided into engineering and sanitation, for the old division of sanitary engineering in the State Department of Health is abolished, the "strictly engineering work" transferred to the state engineer and the remainder entrusted to a newly-created division of sanitation, under the Department of Health. We think the wisdom of such a surgical operation will be doubted by sanitarians and engineers alike. We believe that the consensus of well-informed workers in the health-protective field is that the approval of plans for water supply and sewerage and also the whole range of inspection designed to ensure the proper sanitary operation of such works should be in the same hands—engineering hands. Whether the single responsible department should be that of health or of engineering, is another matter, but to attempt to separate sanitary engineering into sanitation and engineering seems an anomaly, and divided responsibility seems bound to lead here, as everywhere else, to confusion, as well as to either duplication or else deficiency of effort, with possible tragedy. The transfer of much of the engineering work of our states to a single engineering department is a commendable object. How far it should go is open to argument. Its justification must rest in concentration, not division, of closely related duties and responsibilities.

## Human Touch in Society Affairs

ENGINEERS are inclined to be staid individuals. After they have been out of college for five years they acquire a hardened dignity that is difficult to dent. As a consequence engineering society programs show little variation from a serious, technical trend. If the chairman of the program committee, however, could be reminded of the fact that these staid engineers 15 or 20 years back were howling sophomores and racy seniors, he would not fear to put a little humor into a couple of the year's programs. We do not know what sort of argument is followed by the program committee of the Providence Engineering Society, but the result is good. Last November it held a smoker in order to organize a local section of the Pipe Stokers' Union, the requirements for membership being "mental muscularity, a belief in good fellowship, a sense of honor in humor, and a love for lullabies." Rigid tests in all requirements were given the applicants and a free ticket to the annual banquet to the one making the best showing. The March smoker was the occasion of a "supposium" on the production of free power, and prizes were awarded those with the best suggestions of how to get something for nothing. Entering into the same spirit, the president, at the annual dinner, enlivened the serious and dignified gathering by some ideas on a new society house. These are reproduced, in brief, on another page and will, we believe, be of as much interest to the wide circle of readers of *Engineering News-Record* as it was to those privileged to attend the Providence dinner. Boys like to be boys even though they wear the silvery wreath of fifty or more winters.

## Pontoon Bridge Across the Hudson

FROM both the technical and the economic points of view the project, described in this week's news pages, for spanning the Hudson River with a temporary pontoon bridge to be located just north of the New York City limits is of decided interest. Structures of this general type are a well-developed feature of military engineering practice, but their use for commercial pur-

poses, while not without precedent in this country and Europe, is distinctly out of the ordinary. The main feature of the proposed Hudson pontoon is the employment of a number of the U. S. Shipping Board's wooden vessels—which the ending of the World War converted into "white elephants"—as the floating supports of the main bridge structure. The technical feasibility of the Hudson pontoon structure has been indorsed by Gustav Lindenthal, the distinguished bridge engineer. While no engineering details have as yet been made public, it is understood that the plans contemplate a provision of possibly 40-ft. clearance, for tugboat, barge, and small craft traffic, by means of tower supports extending above the ships' decks to carry the bridge girders. At the main river channel a lift span is contemplated. As a speedy, temporary method of facilitating interstate vehicular traffic the pontoon bridge has much to recommend it. It will be several years before the Hudson River vehicular tunnel, for which ventilating shafts at one end are now under construction, can be completed. By existing ferry routes much time is lost and traffic congestion is great. The pontoon bridge, however, is a means to an end rather than an end in itself. With traffic moving across the Hudson on such a structure there would be afforded a convincing argument in favor of a permanent method of crossing.

### Delivering Mixed Concrete

CENTRAL concrete mixing plants with long distance delivery of the wet, mixed concrete have many advantages for road work, but the possibilities of segregation in the mix with remixing required at the site have always acted against their wide use. In the Imperial Valley work noted on another page, the difficulties apparently have been overcome with such success that it is proposed to continue the method on other jobs. If mixed concrete can be successfully transported over the construction roads of that district, roads which for roughness and general hopelessness have no equal in the country, certainly it should be possible to do so anywhere. The solution lies in a proportioning of the concrete so that it reaches its proper consistency after the jolting of its ride and not as it leaves the mixer. Unfortunately there are not yet rules, empiric or otherwise, whereby the engineers can design the concrete mixture so as to insure such a consistency, although the Imperial Valley job tends to show that a maximum density mix is also one which transports most effectively. The main lesson is that by proper study and experimentation mixed concrete can be moved long distances over rough roads and safely and economically placed.

### Rail Specifications Again

AN ATTEMPT to harmonize existing differences between rail makers and rail users and to break the rail specification deadlock by submitting a new specification for consideration of both parties has been made by a neutral authority, as recorded on p. 202. For several years there has been a desire for specifications which will ensure rails of better quality and less subject to failure, but unfortunately differences of opinion have resulted in a deadlock. According to a statement issued some months ago by G. J. Ray, chairman of the rail committee of the American Railway Engineering Association, the rail manufacturers have offered no constructive assistance in the preparation of the committee's specifications, but have negatived their introduction by refusing to accept orders based on these specifications. In both the A. R. E. A. and the American Society of Testing Materials there has been consideration of the advisability of issuing two standard specifications; one for general use and the other with certain special requirements for which additional charges would be made (see *Engineering News-Record*, March 24, 1921, p. 515, and June 30, 1921, p. 1127). These latter specifications would be for the use of railways which consider that the specially-made rail would be worth the extra price. Now comes Robert W. Hunt, the veteran rail expert, with a proposed new specification which he has submitted to railway engineers and manufacturers in the hope of securing mutual approval. That improvement in rail manufacture is needed is evident, and it will be interesting to note how the two parties to the controversy and deadlock will react to this authoritative neutral proposal. A discussion of the same subject in another aspect appears farther on in these columns.

### Fall Highway Lettings

IN THE news columns of this week's issue will be found a letter which Secretary of Commerce Hoover has just sent to the governors of the various states urging the award of road construction contracts in the fall of the year. The economic desirability of the course of action outlined by Mr. Hoover has long been recognized and highway engineers and contractors, for years past, have favored the award of contracts well in advance of the opening of the construction season in order that the work might be intelligently planned, organization perfected and the necessary materials provided for. *Engineering News-Record* has continuously amphasized this point of view in its editorial pages. In spite of the arguments advanced for it, however, the practice of advertising in mid-winter has generally not been followed by the states. The weight of Mr. Hoover's influence, however, may help in getting results. During a period of unemployment, such as now exists, added force is given to the plea for early highway lettings. Many men, now out of work, would thereby be provided with jobs. The highway programs in many states are now reaching proportions so large as to make eleventh-hour contract lettings indefensible.

### Further Railroad Relief

MUCH UNCERTAINTY in the railroad situation should be dispelled by passage of the bill to carry out President Harding's recommendation for legislative relief to railroad credit by funding the railroads' indebtedness to the government for capital expenditures made during Federal control. Payment of undisputed claims has been withheld by the Government to offset the carriers' indebtedness for capital-account expenditures. Thus the companies have virtually been forced to pay cash for capital account out of current earnings. Even in prosperous times this would be extraordinary railroad financing. The half a billion dollars involved is a sum large enough to cause the carriers great embarrassment if they are required under present conditions to meet the obligation by employing directly their own credit. But the bill is not a subsidy and requires no appropriation by Congress. It merely enables the War Finance Corporation to take over the railroads' obligations in the hands of the Railroad

Administration, accept the railroads' securities and use them as the basis of securities of its own which it will proceed to dispose of. In other words, the railroads are to be temporarily aided by the credit of a government corporation during a period of transition.

## Research to the Fore in Rail Matters

THROUGH the deadlock in the development of rail specifications that came into being within the past few years and which was pictured clearly by George J. Ray, chairman of the rail committee, at the meeting of the American Railway Engineering Association last spring, one line of progress in rail improvement seems stopped for the time being. There appears to be no one item in the quality-testing of rails on which buyers and sellers are sufficiently agreed to supply a starting-point for further advance in shaping specifications so that they will assure good rail. Meanwhile, however, research concerning the defects of steel rails and the determinative factors of rail-steel quality goes on, though it is necessarily slow work. In the results of this research seems to lie the main hope for rail improvement at the present time.

In a sense the specification deadlock represents an indictment of our knowledge of testing. Testing as applied to rails, it will be appreciated, means determining quickly by the examination of a piece of rail whether other rails made at the same time in the same mill will give safe service in track during a long period of years. Obviously this is a difficult and delicate problem, but it is of quite the same character as the problems involved in all other acceptance testing. Such testing has been developed into a large and resourceful art, and with respect to most classes of material it yields surprisingly effective results. But in the case of rail, the tests that we use do not appear to be dependable indicators of whether the rail will be good or bad in service. The testing engineer does not know, in other words, how to tell a good rail except by its service. This means that the art of testing fails, for the present, in the particular application in question. The situation suggests that our knowledge of testing needs to be developed beyond its present stage.

At the same time it is well to note the fact also that the rail maker does not know how to *produce* good rails, because, like the testing engineer, he does not know how to tell a good rail. He does know, it may be conceded, how to make good steel—steel good for certain other kinds of service—and also how to roll well, but this is only indirect knowledge so far as rails are concerned, in the absence of information on how rail service is correlated with good steel or careful rolling. It is known that special care in the mill, and special effort, or inspection to assure such care, will result in good rails. Further, it is obvious that the avoidance of hit-or-miss variations in the finished rail produces a desirable result, and that uniformity of process is a favorable factor by resulting in uniform material. Nevertheless, uniformity is not a primary desideratum; it is possible to produce uniformly *unsuitable* material. First the methods must be known that are sure to produce the desired good material. Only after this is uniformity of value.

These limitations on both sides of the rail-testing situation have naturally led railway engineers to seek rail improvement by the rather arbitrary process of making the selection more severe. The motive for doing this, it should be carefully remembered, is not that present rail is unsatisfactory, but that a large quantity of good rail is accompanied by a certain small (perhaps very small) proportion of bad rail, which in the interest of good railway service it is important to eliminate. Because of the elusive nature of the defects involved, the buyer is driven to the hopeful assumption that more rigid application of tests for strength, ductility, and uniformity of composition will be likely to strike mainly at the poorest of the rails produced. And his argument is the more plausible because of the demonstrated fact that rail service is largely a function of the morale of the rail producer's organization—and more severe specifications when properly applied will tend to raise this morale.

The process holds promise, but it is obviously costly and uncertain. It involves, moreover, a number of technical points in testing that are subject to great differences of opinion, among them the question of how to obtain a representative sample, and the question of what range of conclusions may be drawn from the results obtained with the sample. It is not surprising under the circumstances that there has been disagreement between rail buyers and rail makers over this policy of increasing the severity of testing and increasing the percentage of rejection of rail, without increase of selling price—disagreements that probably would not arise in the same form or degree were it certain that the more rigid requirements will really eliminate the bad rails.

On the other side of the controversy it is necessary to take account of the fact that apparently it costs no more to produce good rail than to produce bad rail. As against the results now being attained, under an efficient system of production it should cost no more to make 1,000 good rails than to make 999 good and one bad rail. An increase of price for dependably good rail therefore appears illogical. The rail buyer seems to take this view, and correspondingly his objective is to force the rail maker to produce only good rail without charging a punitive price therefor.

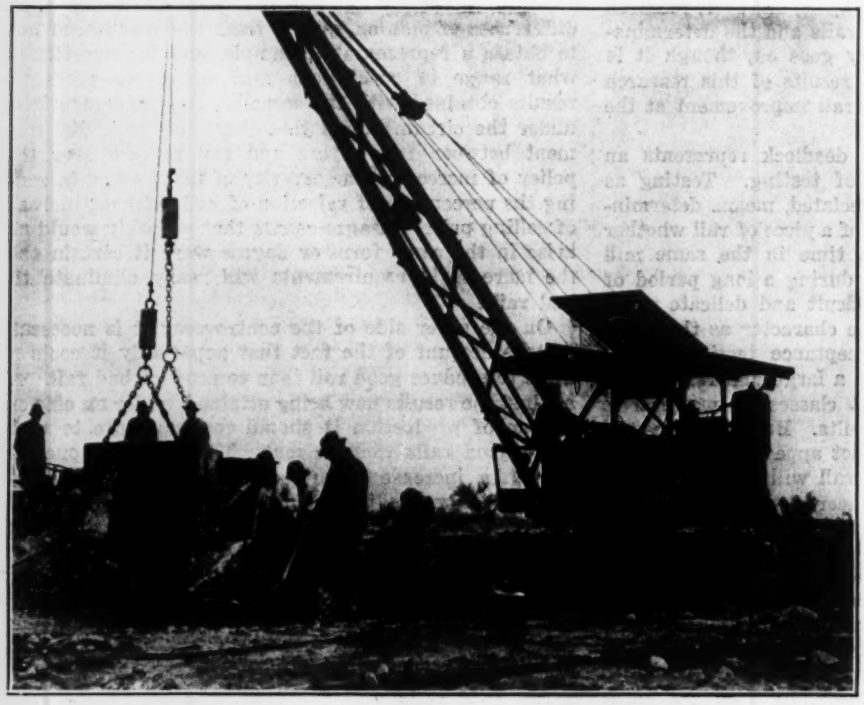
The deadlock now existing has its root in facts of this kind. It involves the desire of the one party to impose more restrictive test requirements without real certainty that they will sift out the few bad from the many good rails, and the determination of the other party not to submit to such requirements without large increase of price. Either side—for both sides are beyond question anxious to make and use only good rails—could break the deadlock, did it only know precisely the nature of defective rail quality and how it may be identified in tests. In the absence of this knowledge, however, direct improvement of rail purchase specifications seems blocked for the time being.

Research then, is the road to progress, as already stated. Once this is fully understood by all interests concerned in rails, it may be expected that the contention over rail specifications will be shelved, and that, except for further discussion of satisfactory methods of sampling, the current market specifications will be left standing. If at the same time all effort in the field is concentrated on research into the underlying scientific and metallurgical problems, especially if means be provided for prompt interchange of all new observations and conclusions, rail development is likely to enter a new epoch.

# Concrete Hauled Three Miles From Central Mixing Plant

## Twelve Miles of Pavement Laid on Desert from Two Mixer Set-Ups—Day Labor Plan—Same Method to Be Used Elsewhere in California

A 12-MILE concrete paving job, which is nearing completion on the main line of the California State Highway south of the Imperial-Riverside county line, is being served from a central mixing plant which was moved only once during the work. That is, the concrete mixer was set up first at the 3-mile point and, when the first six miles of road had been built, was moved to the nine-mile point, thus requiring a maximum concrete haul of three miles. At the present rate, using only a single 8-hour shift and despite the unusual and difficult conditions under which the work had to be carried on, the entire 12 miles will be completed within 5½ months. The operation of the central mixing plant has been so successful that plans are being made to move the equipment to another location in southern California where the same method will be applied to road work on which speed in construction is an important factor.



DUMPING BATCH BOXES ON THE SUBGRADE

Note two-line rig, attached to spindle on box by means of which box is overturned. The maul is used for striking the box after overturning

The desert work was undertaken by the commission on the day labor plan only after advertisement for bids had failed to bring any offers. The lack of interest on the part of contractors was ascribed to the fact that the territory traversed is some 200 ft. below sea level in a hot, arid climate which is not at all attractive to labor and which makes it necessary to exercise more than ordinary care to secure good concrete. Still further special requirements were introduced by the fact that water had to be pumped as much as 14 miles to supply part of the work, the nearest railroad station was at Mecca, 25 miles away and the nearest machine shop was at El Centro, 60 miles away.

The commission established a main or headquarters camp to accommodate about 130 men at a point such that it was a central location for the paving work, the crusher, the screening plant and other phases of the operation as a whole. The men were permanently quartered in this main camp and were transported by motor trucks to and from their work morning and evening. The decision to use motor trucks for all transportation in connection with this work was influenced by the fact that the commission had a considerable stock of war equipment on hand. About 37 motor trucks were kept on the job. Of these 6 to 8 were kept as spares and those in service were distributed according to the requirements for hauling sand, gravel, cement and concrete. A repair shop for the trucks was maintained at the headquarters camp.

To secure suitable rock, a rock crushing plant driven by a gasoline engine was installed near the north end of the job. Here suitable material could be quarried from hard rock which was found in sizes convenient for handling after a little bull-dozing. A feature of operating a rock quarry at this point was the necessity for using a hammer to break off of the rock the coral deposit from a few inches to several feet in thickness which was formed some thousands of years ago, according to geologists, when this area was below the surface of an arm of what is now the Gulf of California.

The sand screening plant was located in a dry stream bed, or "wash" close to the road and not far from the center of the 12-mile stretch. The quality of the sand was satisfactory as to grading except that it contained about 17 per cent of "fines." The specifications called for not more than 6 per cent of material that would pass a 100-mesh standard sieve, so in order to use this sand it was necessary to install a 6-in. air blower with which to force a current of air through the stream of material as it fell from the screen (with ⅜-in. circular holes) to the bunkers. This did not drive out a sufficient percentage of fines until the coarse material had first been separated, so the air current would not have to force its way through a stream containing the heavier material. As finally arranged, the most successful method of eliminating the fines was to separate the coarser material from the sand by means of a 10-mesh

screen placed under the upper section of the ¾-in screen and about 2 in. from it. Materials passing the 10-mesh screen were caught in a hopper having an outlet ¾ in. wide by 18 in. long immediately below which was the blower jet, 2 in. high by 20 in. in horizontal width. The fines were blown through a closed chute to a convenient waste pile. The air-cleaned sand was conducted into the same bin as the material between ⅛ in. and ¾ in. in size and was remixed while being drawn off into trucks. The resulting sand satisfied the specification requirement.

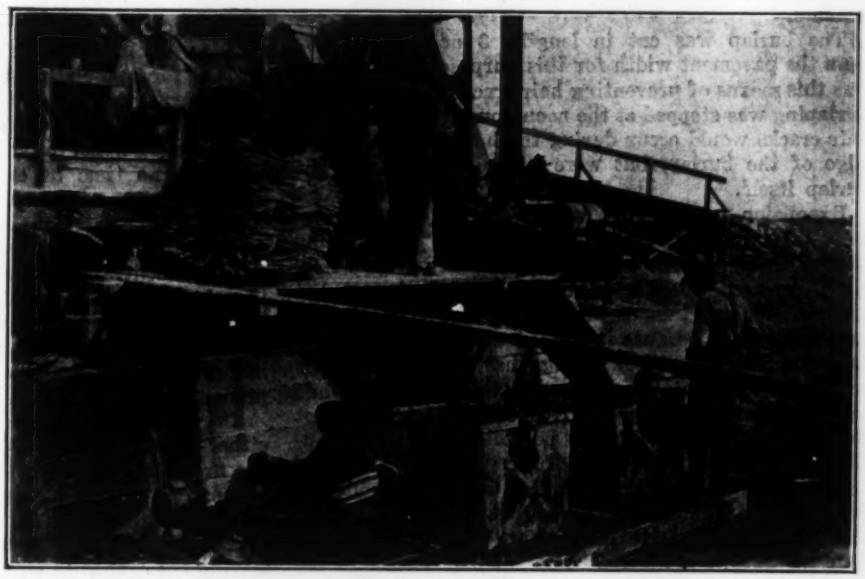
For the most part the road traverses a sandy formation and as the climate is very arid the first problem was to get enough water onto the subgrade so it could be well compacted. As the rough grading was being done, a water pipe from 4 in. to 2 in. in diameter was laid along the road and faucets were put in at 100-ft. intervals so that the subgrade could be well sprinkled. Most of the sprinkling was done at night, using hose in 100-ft. lengths. The main pumping unit delivered 60 gal. per minute against a pressure of 300 lb. per square inch at the pump. The rough subgrade was compacted from 1 to 3 in. with a 12-ton roller and by repeated sprinkling it was found possible to get the soil thoroughly wet to a depth of 12 to 15 in. before the concrete was placed.

At both locations the central mixing plant was so arranged that sand and gravel, delivered by trucks, could be dumped into bins whence bucket conveyors elevated them to bunkers over the mixer. In order to keep down the height of these bunkers a depressed driveway was excavated under the mixer spout and the trucks used for delivering the concrete drove down into this driveway to receive their load. Two 4-sack batch boxes were hauled on each truck. A 4-sack batch mixer was set to discharging directly into these batch boxes on the trucks. Each truck waited, after receiving one batch, for the mixer to turn out the second batch. This wait amounted to a little over one minute. Working without interruption, this mixing plant would turn out 125 cu.yd. of concrete in 8 hours. A 1:2:4 mix was used.

A platform was built in the depressed driveway on a level with the truck body to serve as a station for a workman whose duty was to prevent any stoppage in the movement of concrete down the spout from the mixer and to swab the square corners of each batch box with oil before it received its charge. Oil drained from gasoline engine crank cases was used for this purpose. The oiling was found to be well worth while as it made possible a quicker and more complete emptying of the box.

After experience with a central mixing plant the chief problem, the engineers point out, was to so plan the work that separation of cement and aggregate would not occur while the concrete was in transit from mixer to pavement. Factors affecting this are the roughness of the road over which the concrete is hauled, time of hauling, amount of water used in the mix and the grade of sand used. With some experiment it was found entirely feasible to haul properly proportioned concrete a distance of three miles over very rough construction roads, the trip occupying 25 minutes, without causing the separation of material. When the haul exceeds 0.8 mile, one to two pounds of hydrated lime per sack of cement is added to assist in preventing segregation of the aggregate.

It was found that if a slight excess of water was present, separation would occur. For example, a quart or two of water left in the batch boxes after rinsing them out was found to dilute the mix enough to cause separation. When separation has actually occurred, the reports of engineers on this work state that the condition of the concrete is so changed that the fact is at once apparent. Batches in which separation had occurred were not used in the pavement.



FILLING BATCH BOXES AT CENTRAL MIXING PLANT
Note that truck roadway is depressed. Can in foreground contains oil for swabbing out boxes before concrete is loaded

At the point where the paving was in progress a locomotive crane on crawler treads moved along the subgrade just ahead of the fresh concrete. This crane lifted the batch boxes from the trucks and dumped them on the subgrade just ahead of the tamping machine, the unloading of the two batch boxes requiring an average of about 1 min. and 40 sec., the time being measured between the stopping and starting of the delivery truck.

On this job ¾-in. transverse rods were placed in the pavement on 18-in. centers and ½-in. longitudinal rods are placed along the headers, one on each side. A template dragged along the subgrade by the locomotive crane served the double purpose of template and storage car for the reinforcing bars. Ordinarily about 500 lb. of reinforcing steel was kept loaded on the template, thus being in a convenient location for the men placing

the reinforcing steel at the same time that the template was properly weighted. The material from irregularities in the subgrade scraped up ahead of this template was thrown out onto the shoulders by shovel men. The reinforcing steel was held at its proper height in the pavement by the usual pipe supports. Fine wires, running from bar to bar at 4-ft. intervals, were tied to the steel as it was laid so as to hold the bars in their proper transverse position.

Floats were used to finish the concrete behind the belt attached to the tamping machine. A very convenient float was found to be a piece of light sheet metal curved up at the edges, attached to a wooden handle.

Because of the percentage of fines in the material which it was difficult to keep very low, and because of the extreme arid conditions under which the pavement was laid, difficulty was experienced in preventing hair cracks on the surface. A preventative that proved eminently successful was the use of burlap in 6-ft. widths laid across the pavement and sprinkled very soon after the concrete was finished. The strips of burlap were prevented from blowing off by rocks or earth shoveled on the ends of the strips just outside the headers.

The burlap was cut in lengths 3 or 4 ft. longer than the pavement width for this purpose. So effective was this means of preventing hair cracks that where the burlaping was stopped at the noon hour not infrequently hair cracks would occur during the hour up to the very edge of the burlap, but were never found under the burlap itself.

Expansion joints 1½ in. wide were put in the pavement at the end of each four-hour run. These joints were formed by transverse headers which were afterward replaced with a mixture of sawdust and hot asphaltic oil well tamped into place. The sawdust mixture was chosen because in the extremely high temperatures on the desert something that will not melt is required in the joint, and because this material, when squeezed up in ridges by the closure of the joint in hot weather, was soft enough to be rolled down by pneumatic tires without causing jolting.

Because much of the road was built across débris cones below the mouths of canyons where the water course shifted from year to year, very few culverts were installed, but instead "dips" or depressions in the pavement were put in to allow the occasional flood waters to go over the pavement. These dips varied from 30 ft. to several hundred feet in length. In their lower portions where actual submergence was expected, the pavement width was increased 3 to 5 ft. and the down-stream edge was terminated in a 45-deg. slope with a 6-in. toe wall at the bottom.

The work is being done on the day labor plan by the California State Highway Commission. Austin B. Fletcher is chief engineer and W. W. Patch is division engineer in charge of the work described in the foregoing.

## Magnetic Testing of Coil Springs

**In a series of tests of large coil springs by the magnetic-induction method, T. Spooner and I. F. Kinnard found during the past year that magnetic retentivity gave a satisfactory indication of the hardness of the springs. The figures checked closely with micrographic and Brinell-hardness examinations of the pieces. Details of the tests were reported by the investigators before the American Society for Testing Materials recently.**

## Handling Sugar Refinery Wastes

POLLUTION of St. Mary's River in Indiana by the Holland-St. Louis Sugar Co. refinery, causing a nuisance, is to be abated. Following an investigation by Pearse, Greeley & Hansen, consulting engineers, Chicago, in co-operation with the State Board of Health and State Conservation Department a plan of action has been approved by the state officials whereby the refinery will dispose of the various wastes without offense. Lagooning to permit a flow commensurate with proper diluting capacity of the stream, chemical precipitation and screening are all to be used.

Four wastes are to be handled: (1) Beet carrying and wash water, 2 m.g.d.; (2) diffusion battery and pulp-free water, 0.2 m.g.d.; (3) lime press cake, 37 tons as a solid 50 per cent moisture cake or 0.15 m.g.d. when diluted with water to make a liquid that will readily flow; (4) Steffans house wastes, 0.2 m.g.d.

The first waste contains beet tails, taps, roots and earth, but little organic matter. Since its biological demand is zero it will be kept separate from the other wastes, passed through fine screens and discharged continuously into the river.

The second waste contains much organic matter in solution and considerable in suspension. Methods were devised for coagulating and settling the solids so that the supernatant liquid could be discharged into a storage lagoon and from there into the river at a rate more or less proportional to the stream flow so that the stream would at no time be excessively polluted. Finally a method was worked out with the company superintendent for re-using these wastes. The treatment comprising liming and carbonating in a manner similar to the treatment applied to the main volume of juice in the plant and then re-using the liquid in the diffusion batteries. The non-sugars are precipitated and filtered out, leaving as a waste a lime press cake which will not greatly increase the volume of such cake already produced.

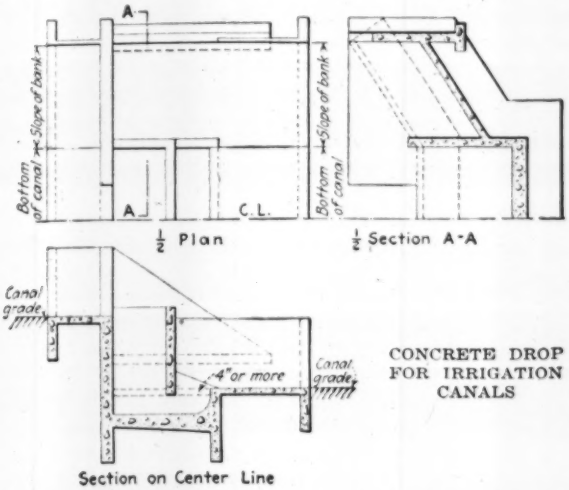
The lime press cake, the third waste, may be handled either as a relatively solid cake or as a thick liquid. In the first instance it would be removed by narrow gage railroad to a dump, but the method is objectionable because of the difficulty of obtaining labor during the concentrated 100-day "campaign." The company favors mixing the cake with water used in cleaning the presses and pumping it to lagoons for storage until the volume of flow in the river is sufficient to afford ample dilution.

The fourth waste is exceedingly strong in organic matter, although low in suspended solids. It results from a process used to recover additional sugar from the molasses after the first direct recoveries have been made. This will be evaporated in multiple-effect evaporators and the final syrup ignited for the recovery of potash. Before ignition the syrup will probably be barrelled and sent to a fertilizer works. This process of recovering potash is not new and has been used at this plant. In 1918 a fire destroyed the building in which it was housed and on account of the low price of potash the process had been abandoned. It is unlikely that the process will pay for itself but as a disposal method it will be reasonably economical. Biological processes have not been considered feasible because of the short period of the campaign, which starts in October when the stream flow is low. The biological process requires several weeks to ripen during which period most of the damage in the way of pollution would have been done.

# A New Curtain Wall Drop for Irrigation Canals

By H. M. Chadwick
Chief Engineer, Rogue River Valley Canal Co., Medford, Ore.

SIMPLE drops of the curtain wall or confining-chamber type for making vertical changes in the grades of the irrigation canals of the Valier-Montana Land & Water Co. have proved as successful as some of the more elaborate designs and have advantages in both economy and simplicity. This simpler design is to be used also on the new work of the Rogue River Valley Canal Co., in Oregon. This drop was the result of observing other types in operation and noting the points where revision was most needed. Heads up to




CONCRETE DROP FOR IRRIGATION CANALS

6 ft. and bottom widths of canal not exceeding 8 ft. are the limits considered practicable.

Many drops of older designs have failed because the erosive action of the water in passing from the discharge end of a drop into the earth section of the canal has not been overcome. Although the velocity and eddying may be sufficiently stilled by the construction of an extra long water cushion or the construction of a notched breast wall and suitable length of water cushion, it was decided that a more simple and economical design was sufficient.

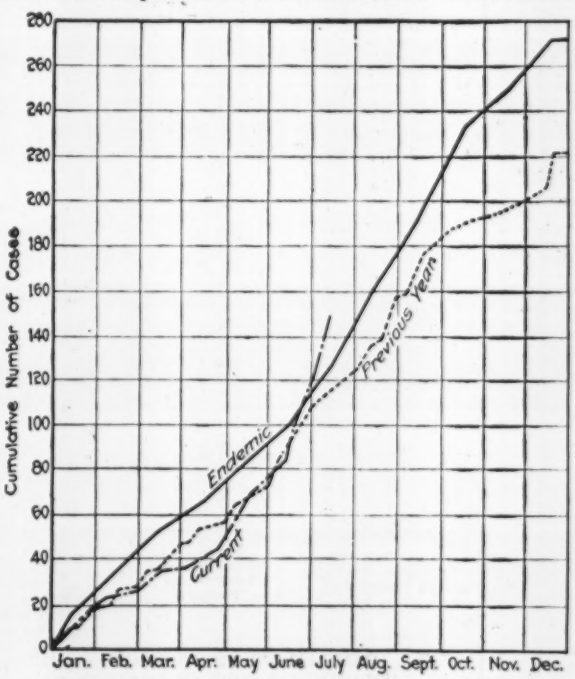
A drop having a curtain wall extended across the main body and carried to a point well below the level of the floor of the outlet apron was found to retard considerably the velocity and eddying at the end of the downstream floor. This arrangement makes the opening between the bottom of the curtain wall and the floor of the water cushion a submerged orifice. The curtain wall might be moved closer to the breast wall to act as a baffle, but it is doubtful if this would improve the operation of the drop.

The breast wall is contracted to maintain the full supply depth of water in the canal upstream when discharging at full capacity. This feature, while maintaining depth at full capacity, naturally does not function so effectively at the various stages below full supply level as would the notched breast wall. Further, the contracted sheet of falling water would obviously cause more impact than a diffused sheet. However, the curtain wall drop has shown its ability to still the turbulent water at the outlet. The crest of the breast wall is also designed to be used as a measuring weir and as a check, should the location of the drop prove advantageous for the use of either of these devices. Many drops of this type were constructed in old canals which had cut down below the original bottom owing to the high velocities. In these instances the upstream apron or floor was not built, as the existing bottom would be below the lip of the breast wall.

In view of the possibility of the orifice becoming clogged with tumble weeds, the top of the curtain wall was kept down to the elevation of, or only slightly above the lip of the breast wall, so that in case of complete stoppage of the orifice the water could pass over the curtain wall. In some of the timber drops the curtain walls were constructed of removable flashboards. These weeds get into the canals in spite of careful maintenance and supervision, but with close observance during operation the chance of clogging is remote.

## Cumulative Typhoid Case Curves

AS AN AID to the control of typhoid fever in California, three cumulative case curves are plotted by months for each county in the state, as shown by the accompanying diagram. The curve for comparative purposes is plotted from the successive totals of weekly averages of cases, excluding epidemics. The current rate curve is plotted from the cumulative totals for the




CALIFORNIA CUMULATIVE TYPHOID CASE CURVES

year. A third cumulative curve, similar to the other two, shows the weekly cumulative cases for the full year preceding the current year. In addition, index cards showing the number of cases per week for eight years in each minor registration area are filed by counties and spot case maps for the entire state are used. The same system of curves, cards and maps used to control typhoid is used for the other communicable diseases. The entire scheme is outlined by Dr. Frank L. Kelley, epidemiologist, and Ida M. Stevens, assistant epidemiologist, California State Board of Health, in *Public Health Reports* for June 3 under the title, "Making Morbidity Records Aid the Epidemiologist."

# Structural Features of Chicago Federal Reserve Bank

**Cantilever Trusses Carry Front Wall Above Fourth Floor—Columns on Cantilever Girders and Suspension Hangers—Frame Designed to Permit Conversion Into General Office Building**

CANTILEVER trusses carrying the upper wall columns above the recessed wall at the entrance colonnade, cantilever girders supporting portico columns in two fronts and structural columns in the rear wall, and second floor framing reinforced to carry the weight of interior columns by means of hangers from fifth floor girders are structural features employed to meet conditions of architectural design in the Federal Reserve Bank Building now under construction at Chicago. This building, 153 x 168 ft., is to be twenty stories high, with three basements, but it is being built now for sixteen stories.

On the Jackson Boulevard side, 153 ft., the entire wall, with the exception of the end panels, is set back from the property line from the first to the fourth floors, in order to provide room for a colonnade of stone columns which constitute a feature of the architectural treatment, but which carry practically no live load. In section these columns are only 75 per cent of a circle, the flat back being at the wall line, and the steel columns behind them, which carry the weight of the front wall, are braced at the floors with girders which provide for wind pressure. This arrangement is shown in Fig. 1.

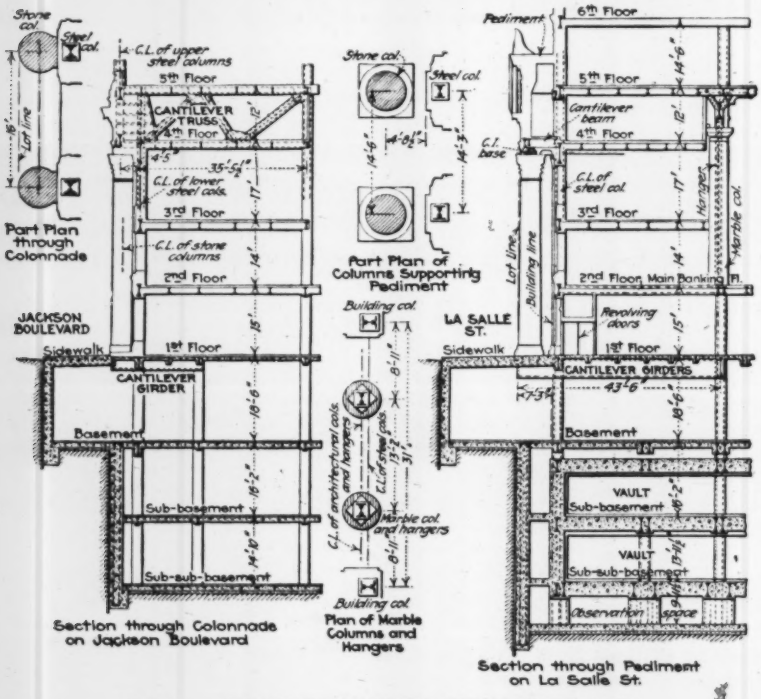



FIG 1. CANTILEVER TRUSSES AND GIRDERS AND COLUMN HANGERS IN CHICAGO BANK

Above the fourth floor the front wall on this side is set forward on the property line, the upper columns being carried by the ends of cantilever trusses having 4½-ft. cantilever arms and anchor arms extending back to the first row of interior columns, as shown in Figs. 1 and 2. Details of the truss are given in Fig. 3. The chords of these trusses form part of the fourth and fifth floor framing. Both upper and lower columns extend the full height or depth of the truss, the shear between them being taken up by heavy web plates reinforced against buckling by horizontal stiffener angles. The load on the footing at the cantilever end of the four long trusses is about 715 tons, with an upward reaction of 90½ tons at the anchor end; for the two short trusses, the figures are 521 tons and 184 tons respectively. A somewhat similar arrangement in the Peoples Gas Building, Chicago, was described in *Engineering News*, March 10, 1910, p. 294.

As the foundation piers along the Jackson Boulevard side are on the line of the columns in the lower or set-back portion of the wall, the stone columns of the colonnade are supported on cantilever girders projecting beyond these piers, in order that all masonry above the sidewalk may be carried on foundations extending to bedrock. The inner ends of the sidewalk joists are framed against an I-beam stringer along the ends of the cantilevers. On the east or La Salle St. side, 168 ft., the wall for the full height and width of the building is set back 7 ft. from the street or property line to permit the introduction of a lofty projecting portico with six stone columns (see Figs. 1 and 2). As it was impracticable to place steel columns and foundation piers under the stone columns, these latter are supported on cantilever girders, this arrangement being the same as on the Jackson Boulevard side, except that the cantilever length is 7 ft. instead of 4½ ft. These first floor cantilever girders are shown in Fig. 4.

In order to reduce as much as possible the weight carried by the La Salle St. stone portico columns and their cantilever girders, the pediment wall above them is made relatively thin. As this wall is over the outer side of the columns it would cause an eccentric loading, to prevent which it is supported on the ends of cantilever I-beams whose fulcrum bearings are cast-iron shoes over the axes of the columns and thus transmit the load centrally (see Figs. 1 and 2). Columns in the rear wall, adjacent to another building, are supported on cantilevers at the basement floor, as piers could not be sunk on the party line. The cantilever distance from center of pier to center of column is 3 ft. 4 in.

In the architectural treatment of the main banking room on the second floor (having its ceiling at the fifth floor level), marble-faced columns are located at points where there are no building columns. The height and headroom of the first story were insufficient to permit of placing in the second floor framing girders of such depth as to carry the weight of these interior

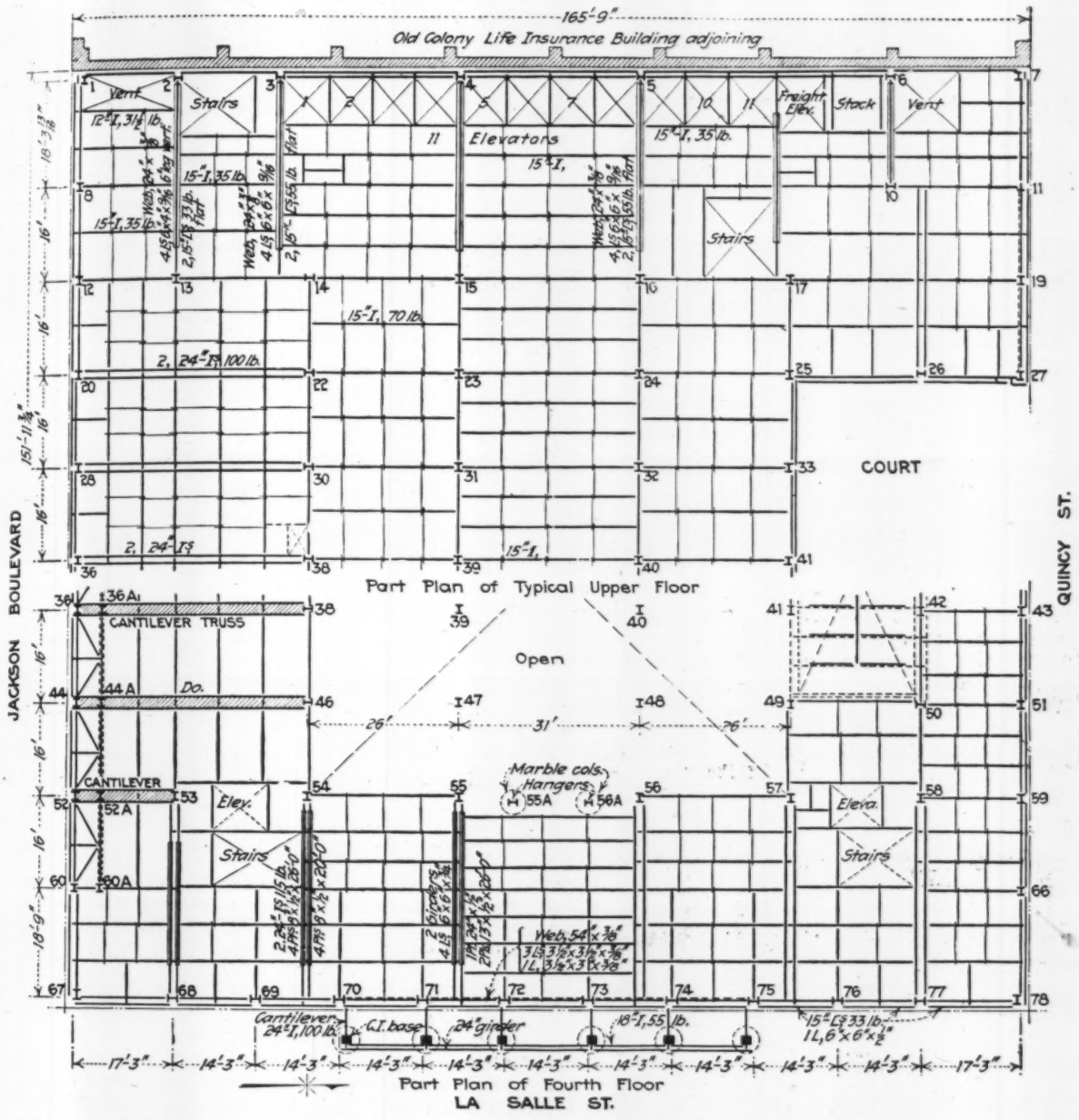



FIG. 2. FLOOR FRAMING PLANS, SHOWING CANTILEVERS, HANGERS AND COURTS

columns. Girders were introduced therefore under the fifth floor, concealed in the architectural beams above the columns, with hangers from these girders to the second floor framing. These hangers, which are inside the marble-faced columns, are I-shaped members composed of four angles and a web plate. To secure a good foundation for the marble, the points of attachment to the floor framing are encased in concrete instead of in the floor tile arches. The general arrangement of these interior columns and hangers is shown in Fig. 2, the details of the hangers being given in Fig. 5.

All main columns are seated on steel grillage on cylindrical concrete piers, none of them being carried at intermediate points by girders supported on the piers, as in some other large Chicago buildings. The piers are sunk to bedrock at 92 ft. below city datum or about 104 ft. below sidewalk level, being built in wood-lined wells or caissons in the Chicago clay. The maximum unsupported height of columns is 42 ft., and the maximum load on a column footing is 2,033 tons (for column No. 5).

The central portion, 80 x 83 ft., of the main banking room on the second floor is three stories high, with a plaster-beam ceiling under the fifth floor. Adjoining the north side of this lofty portion is a light court 22½ x 48 ft., with a skylight at the fourth floor. At the sixth floor this court is extended to the north or Quincy St. line, making an external court 39 x 48 ft., shown in Fig. 2. This court is carried up to the top of the building, thus forming two 51-ft. wings on the Quincy St. side. The steel frame is so designed that a similar light court can be introduced in the south

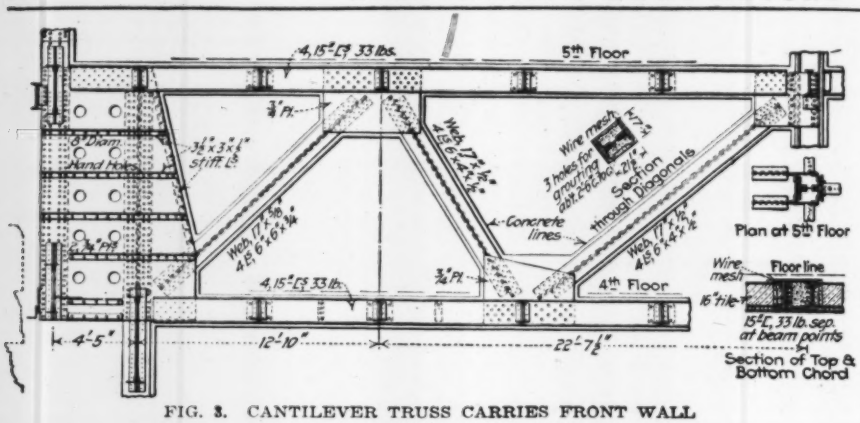



FIG. 3. CANTILEVER TRUSS CARRIES FRONT WALL

or Jackson Boulevard side, if at some time the building should be converted into a general office building.

Floor panels vary from 15 x 17 ft. to 26 x 31 ft., the framing being mainly of I-beams with tile flat arches, except that concrete is used below the second floor. The dead loads used in the design are 200 lb. per square foot for the basement and sub-basement, and 125 lb. for all the upper floors. The live loads are 100 lb. for the two basements and the first and second floors, 130 lb. for the fourth floor, and 50 lb. for the third floor and all floors above the fourth, except that special areas for a lecture hall and file rooms on the fifth, seventh and eighth floors are designed for 100 and 150 lb. live load.

Wind bracing consists mainly of gusset connections between the columns and the tops of the spandrel girders, these gussets being larger on the sides running east and west on account of the narrow wings

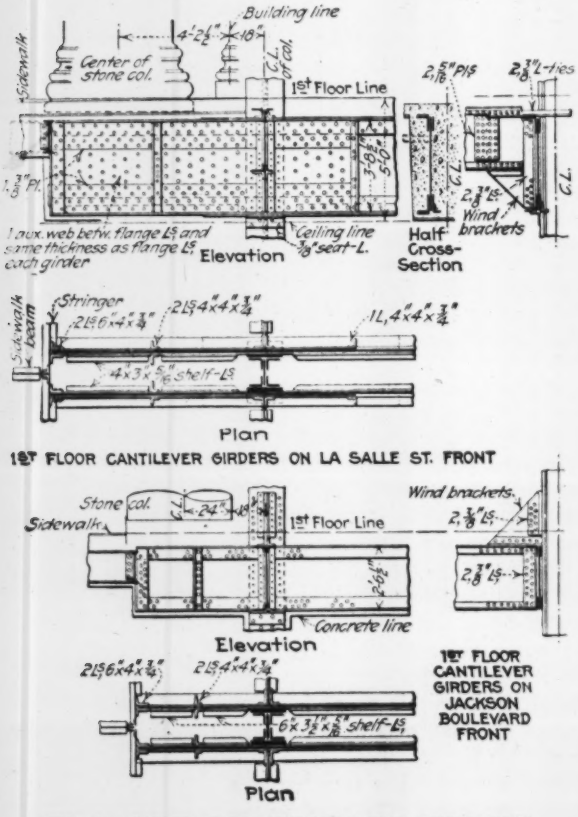



FIG. 4. CANTILEVER GIRDERS FOR ENTRANCE COLUMNS

described above. Wind girders 36 and 30 in. deep are introduced in the faces of these wings, from columns 1 to 20, 44 to 67, 7 to 27 and 51 to 78 (see Fig. 2).

Horizontal bracing in the bottom of the cantilevered framing of the Jackson Boulevard front transmits wind loads from the upper part of the wall to the columns set back in the wall below the fourth floor. Vertical diagonal bracing is used in two panels back of the elevators at the adjoining building, which is fourteen stories high.

This building was designed by Graham, Anderson, Probst & White, architects, Chicago, whose engineering department prepared the structural design. The John Griffiths & Son Co. has the general contract, the steel being furnished by the Morava Construction Co., both of Chicago.

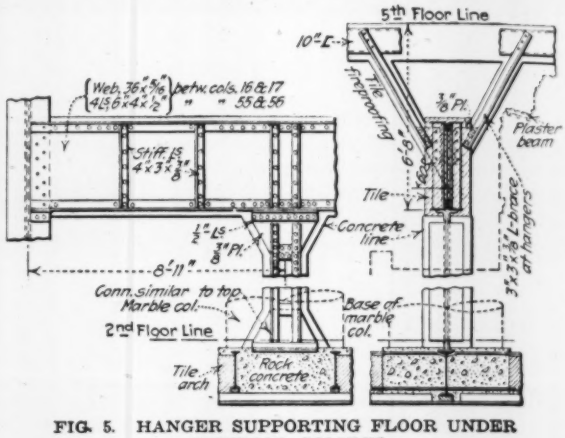



FIG. 5. HANGER SUPPORTING FLOOR UNDER INTERIOR COLUMN

## Fear Fire Danger to Great Timber Windfall

Fear of serious danger from fire in the great windfall of timber created in the forest of the Olympic Peninsula, Wash., by the cyclone of Jan. 29, 1921, has led the National Forest Service to adopt strict regulations in the danger zone including prohibition of smoking. The area swept by the 150-mile wind is 90 miles long and from 20 to 30 miles wide, in which over 6¾ billion feet of timber was blown down by the storm and now lies in a tangled mass. Should fire ever gain headway in this devastated area, foresters say, the greatest conflagration ever known would result. Funds of $100,000 each have been subscribed for fire protection and suppression by the Federal government and the state. Roads, trails and telephone lines have been constructed through the blowdown, and special fire-fighting motor trucks, equipped with several thousand feet of hose and a portable pump engine are located at central points for emergency use. Guards will be stationed on all main lines of travel throughout the region, to see that no one enters except under special permit. Aerial fire patrol will also be maintained from Camp Lewis, Wash., during the danger season, through co-operation of the Air Service, U. S. Army.

# Design and Operation of Locomotive Fuel Oil Stations

## Tank Cars Discharge Into Track Troughs—Storage and Service Tanks—Gravity or Pumped Supply to Engines—Oil Columns—Fire Protection

ON RAILWAYS operating oil burning locomotives, the installations for delivery of fuel to the engine are of a type comparable with water stations rather than with coaling stations, since the fuel is handled by pumps and piping. In general, such an installation has troughs of concrete, steel or wood for receiving the oil from tank cars, which is then delivered by pumping or gravity to storage tanks and then pumped either

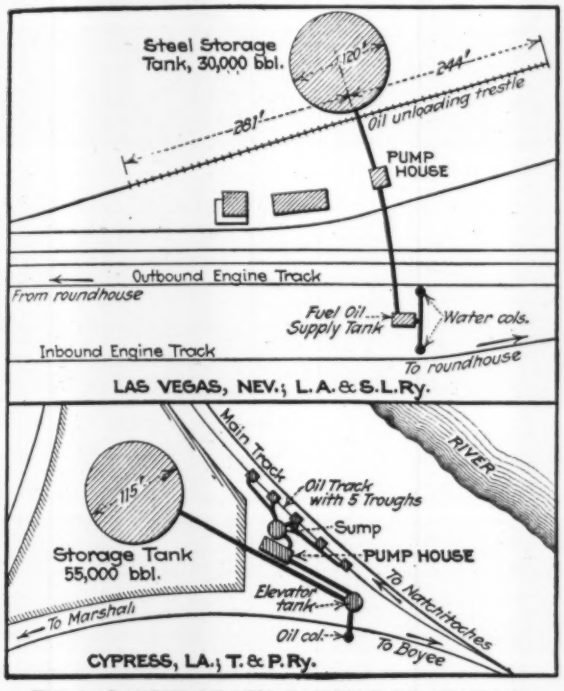



FIG. 1. LAYOUT OF TWO RAILWAY OIL STATIONS

to an elevated service tank or directly to the oil columns from which the tender tanks are filled.

*Oil Station Layouts*—A typical layout of an oil fuel station, shown in Fig. 1, is that of the Texas & Pacific Ry. at Cypress, La. Five troughs are spaced 40 ft. c. to c. on the oil track, to serve five tank cars. From each trough a 6-in. pipe is led to an 8-in. main discharging into an underground covered concrete tank or sump, except that the pipe from the middle trough leads directly into the sump, which is of 15,000 gal. capacity. The oil is pumped from this sump to a storage tank of ordinary steel plate construction and a capacity of 55,000 bbl., 115 ft. in diameter on the surface of the ground. From this tank the oil is pumped again to an elevated steel service tank of 50,000 gal. capacity, in which the oil is maintained at an average head of 12 ft. above the oil column.

Three different plant layouts on the Missouri, Kansas & Texas Ry. may be noted, as illustrating modifications to suit local conditions. At San Antonio, Tex., Fig. 2, there are three unloading troughs delivering to a sump from which the oil is pumped directly through a 10-in. line to an elevated steel tank of 100,000 gal. capacity, the usual separate storage tank being omitted. The two oil columns are served by a 10-in. gravity line from the tank and also by an 8-in. pumping main. At Houston, on the other hand, as shown in Fig. 2, no sump or elevated tank is provided, the three troughs delivering directly to a 50,000-gal. underground concrete tank, from which the two oil columns are supplied by a 10-in. pumping main. At Smithville, Tex., with five unloading troughs, the oil goes to a sump from which it is pumped to a 55,000-bbl. storage tank on the ground. From this tank or the sump the oil is pumped to an elevated service tank supplying the oil columns by gravity. In each case the oil track has separate troughs spaced 40 ft. c. to c.

An arrangement of an entirely different character, with the oil track elevated on a trestle, is used by the Los Angeles & Salt Lake Ry. at Las Vegas, Nev., as shown in Fig. 1. At this point about 25 engines are supplied daily, with an average of 2,000 gal. per engine. Cuts of three to six tank cars are pushed up a 5 per cent grade onto the unloading trestle, which has a continuous trough between the rails, and a lateral trough or covered conduit discharging through the roof of a steel storage tank of 30,000 bbl. capacity. A steam pump with a capacity of 100 gal. per minute draws oil

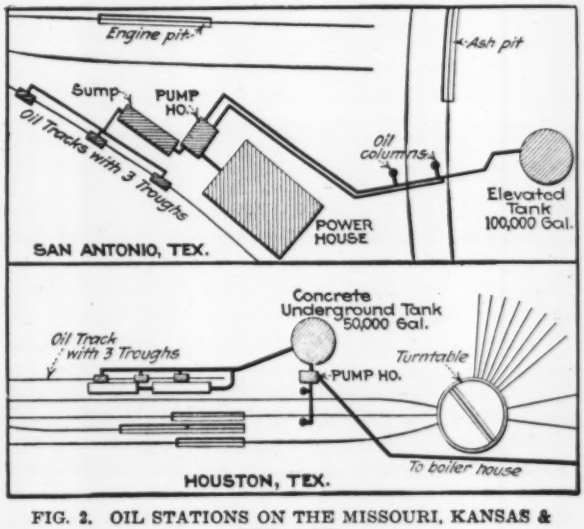



FIG. 2. OIL STATIONS ON THE MISSOURI, KANSAS & TEXAS RY.

from this tank and delivers it to a 20,000-gal. elevated supply tank, from which it flows to two standpipes serving the inbound and outbound engine tracks of the roundhouse.

*Track troughs*—Tank cars bringing the oil supply are unloaded usually by gravity from the bottom outlets standing on a side track provided with troughs between the rail. As a rule there is a series of separate short troughs or hoppers, but in some cases a long continuous trough is installed, as noted above.

Concrete is preferred on the Texas & Pacific Ry. for three principal reasons: (1) The ease with which the depth of the troughs may be varied to give the proper fall to the sump; (2) the ease with which pipe connections may be made, and (3) the non-corrosive proper-

ties. This last item is considered of special importance as the troughs are constructed frequently at points where cinders have been used for ballast and filling. On the other hand, steel plate construction is preferred on the Missouri, Kansas & Texas Ry. Although concrete troughs have been used at some of the smaller engine terminals on the M., K. & T. and have cost less than the steel troughs, the latter are considered more satisfactory, since they are less liable to be damaged and can be moved readily in case of any change in the arrangement of the terminal facilities.

Concrete troughs on the Texas & Pacific Ry., Fig. 4, are 8 x 2½ ft. with a depth of 21 in., the bottom being sloped to a 6-in. outlet. A 1:2:4 gravel concrete is

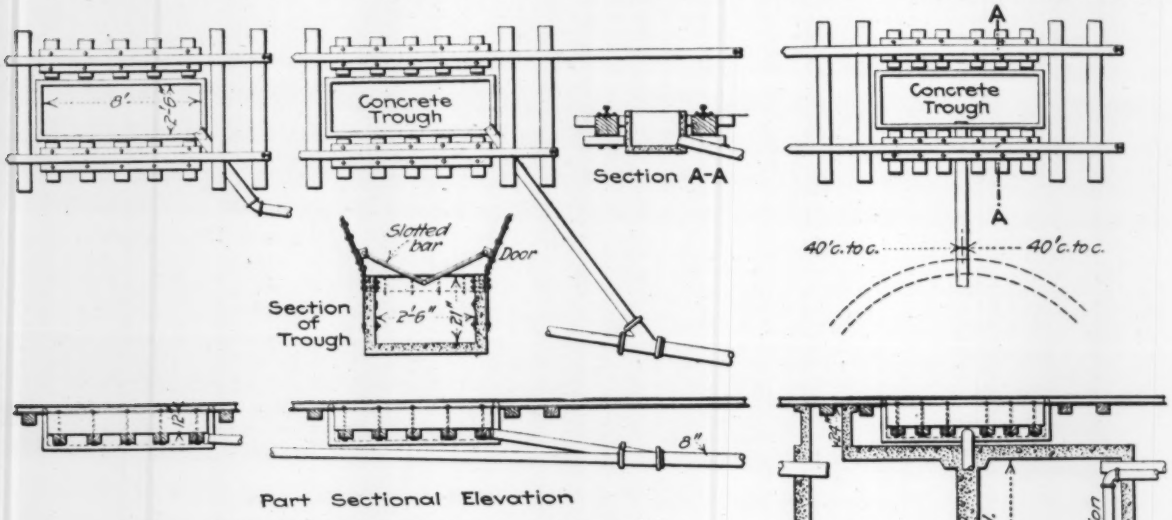
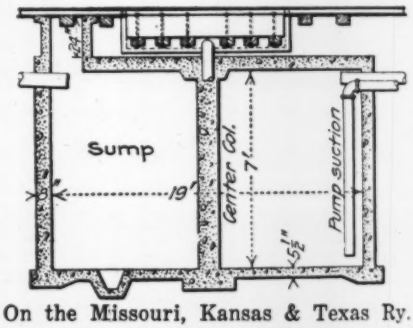



FIG. 3. CONCRETE TRACK TROUGH AND SUMP; TEXAS & PACIFIC RY.

used. The sides and bottom are 3-in. thick, reinforced with chicken-fence wire mesh. Steel covers have strap hinges bolted to the side walls, these bolts being either in the forms when concrete is poured or grouted in afterwards. Slotted bars sliding on bolts in the end walls hold the open doors nearly vertical in order to keep them from fouling the rails and to prevent splashing. Alongside the troughs, each rail is carried by a longitudinal timber resting on wood blocks. Steel troughs on the Missouri, Kansas & Texas Ry., Fig. 5, are 8 x 2 ft. and 24 in. deep, having wooden covers sheathed with galvanized iron. At the troughs, each rail is laid on short ties across a pair of stringers. From each trough a 10-in. horizontal discharge pipe leads to a 10-in. main which is laid in a trench parallel with the track and which in most cases delivers the oil to an underground sump or tank.

The continuous wood trough of the Los Angeles & Salt Lake Ry., Fig. 6, is 24 in. deep and 40 in. wide, built of 3 x 12-in. planks nailed to the caps and track stringers of a framed trestle and put together with splines or feathers in the joints. No metal lining is used. As a protection against fire the trough is covered ordinarily with loose boards or panels having cleats to hold them in place, but at the caps these top boards are nailed to the trough to hold the sides together. A wide plank walk is provided for switchmen and for the men who operate the valves of the cars. This trough is 232 ft. long, with a grade of 1 per cent. A 12 x 36-in. closed wood conduit leads from the lower end of the trough to an opening in the roof of the storage tank, the conduit having a bottom discharge. For the deck of the trestle a special construction is needed to carry the cars at the necessary height above the trough, as shown. On each cap are 12 x 12-in. blocks carrying stringers of the same size to which the track rails are spiked, rods being run through the stringers in order to hold them in position and to maintain the gage of track.

*Storage and Service Tanks*—Underground or surface tanks for storage are used according to local conditions, as noted in the description of layout of oil stations. In some cases an elevated tank combines storage and service facilities. On the Missouri, Kansas & Texas Ry. the oil from the track troughs flows usually to a sump consisting of a horizontal steel cylinder tank of 10,000 or 12,500 gal. capacity, having its top about 2 ft. above the ground to save excavation and unnecessary depth of pipes. Elevated tanks for oil service on this road are usually horizontal steel cylinders of 20,000 gal. capacity, mounted on steel trestles, with the bottom of the tank about 20 ft. above rail level, as in Fig. 6. A few large terminals have 100,000-gal. tanks of the same type and at some of the smaller terminals old 10,000-gal. tank car bodies are used, placed on timber towers.




Steam heat is provided in the tanks and mains, as the heavy Texan and Mexican oils used on this road require to be kept at a temperature of about 125 deg. F. to be sufficiently fluid for pumping and gravity flow. Pipe coils are used in the tanks and a 2-in. pipe is laid in each main, resting loose in the bottom of the main. At each trough the steam pipe in the lateral ends is an attachment for a 10-ft. length of hose to be connected to the heating coil in the tank car and thus facilitate the discharge of oil. Pumps for oil service have usually a capacity of 100 or 200 gal. per minute, increased capacity being provided by number rather than size of pumps.

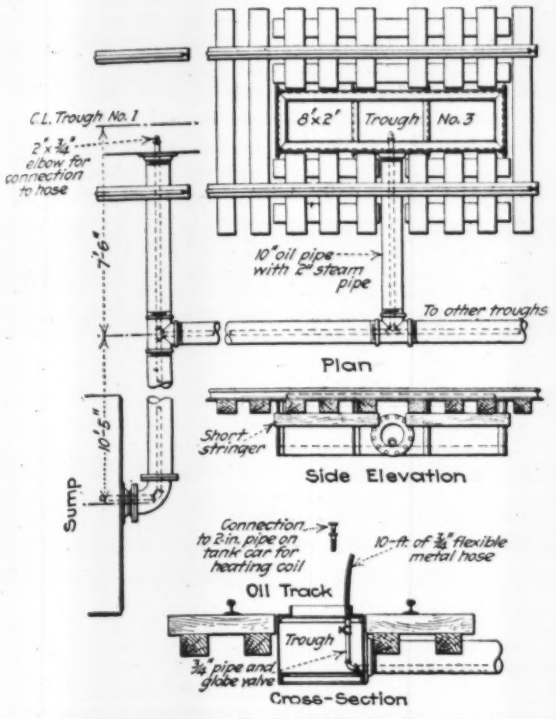



FIG. 4. STEEL TRACK TROUGH: M., K. & T. RY.

A 15,000-gal. concrete underground sump is used by the Texas & Pacific Ry. for its oil station at Cypress, La. This sump is 19 ft. inside diameter and 7 ft. deep, with 8-in. walls and a central column, steel reinforcement being used throughout. Machine-mixed concrete is specified and is given a coat of rich mortar immediately after the removal of the forms, the mortar being worked into the surface with a wood float and then lightly troweled.

Oil is pumped from this sump to a steel storage tank 115 ft. in diameter, having a capacity of 55,000 bbl. This tank is on the surface of the ground and near the outlet it is fitted with steam-pipe coils sufficient to maintain the oil at such temperature as to be

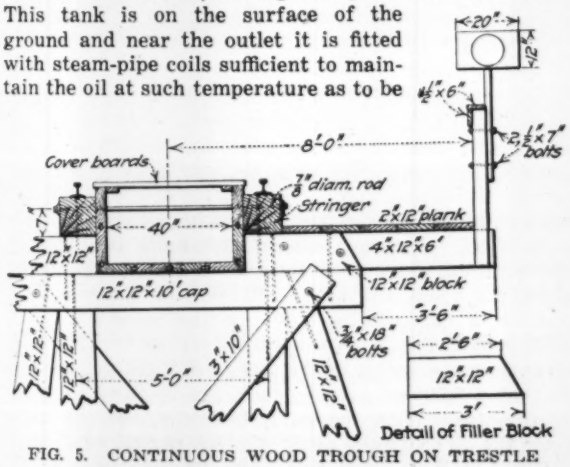



FIG. 5. CONTINUOUS WOOD TROUGH ON TRESTLE

fluid enough to be pumped. Similar coils are used also in the 50,000-gal. steel elevated service tank, which has a conical bottom with sediment drum. These coils were designed for heating the heavy Mexican oil, but have not been used as extensively as was expected. The lighter California oil requires less heat.

The storage tank of the Los Angeles & Salt Lake R.R. at Las Vegas, Nev., is of ordinary steel plate construction and is built above ground. It is 120 ft. in diameter and 14 ft. 8 in. deep, with a plank roof covered with gravel and asphalt composition roofing and having a circular monitor or raised section for ventilation at the center. Radial rafters are supported by ring girders and a shelf angle inside the shell, the girders being carried by posts which rest on plank footings on the bottom plate. A pipe radiator 20 ft. square is placed in the tank, with connections for both live and exhaust steam, in order to maintain a temperature of about 100 deg. F. This road uses California oil.

Through the side of the tank, at the bottom, stands an 8.-in. outlet, with a gate valve on the outside and a hinged length of 8-in. pipe on the inside, the open end of this pipe being held at any desired level by a chain operated from a roof manhole. An 8-in. suction main

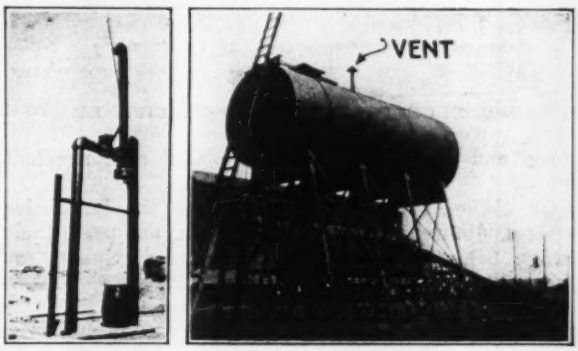



FIG. 6. SERVICE TANK AND OIL COLUMN: M., K. & T. RY.

leads from the tank outlet to the pump house and a 6-in. force main thence to the elevated supply tank, both of these being of wrought iron pipe with threaded sleeve joints. The supply tank is horizontal, 10 ft. in diameter and 35½ ft. long with flat conical ends. It is supported on a timber frame or tower, though steel and concrete bents are used at other points, the bottom of the tank being 15½ ft. above rail level. A pipe radiator is fitted inside the tank to maintain the oil at 100 deg. F. The 6-in. supply pipe is carried up and connected to a manhole on the top of the tank. At one end is a 10-in. cast iron outlet pipe attached to the bottom of the tank and carried underground to the standpipes or oil columns.

*Fire Protection*—Special provision must be made for the fire hazard incidental to the storage and handling of oil. The Missouri, Kansas & Texas Ry. equips its oil stations with small portable fire-foam engines. Surface storage tanks are fitted with pipe systems for blowing live steam across the top to quench the flames, these tanks being surrounded by low earth banks to retain the oil in case of bursting or leakage of the tank. The rails of the engine tracks at oil columns are bonded to prevent stray electric currents from flowing through the engine to the pipes and causing a spark. At the main receiving station at Galveston, where the installations were made by the Mexican Petroleum Corporation, a complete "foamite" installation has been made for smothering oil fires, but the expense for such equipment was not considered necessary at railway oil stations.

On the Texas & Pacific Ry., storage tanks are equipped with steam pipes and surrounded with earth banks. Hand chemical extinguishers are provided at the pump

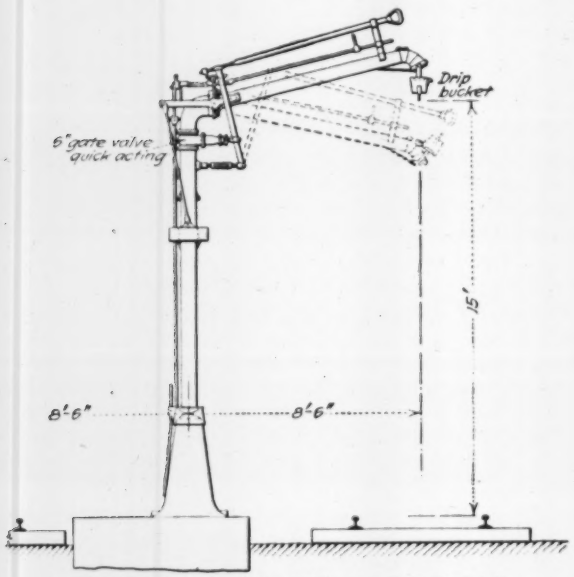



FIG. 7. OIL COLUMN: TEXAS & PACIFIC RY.

house and barrels of sand are placed at convenient points.

*Oil Columns*—To deliver the oil to the locomotive tenders, different types of oil columns are used, their design being very similar to the water columns for supplying the tenders with water. In fact, the Texas & Pacific Ry. uses a water column adapted to this purpose (Fig. 7) and supplied by an 8-in. main from the elevated tank in which the level of oil is maintained at about 12 ft. above the oil column. The horizontal spout is swung across the track when in use and can be depressed to the tender manhole, a 6-in. quick acting gate valve at the head of the column being operated by the fireman by means of a rod on the spout. To catch the oil drip after use, a small bucket is hinged to the

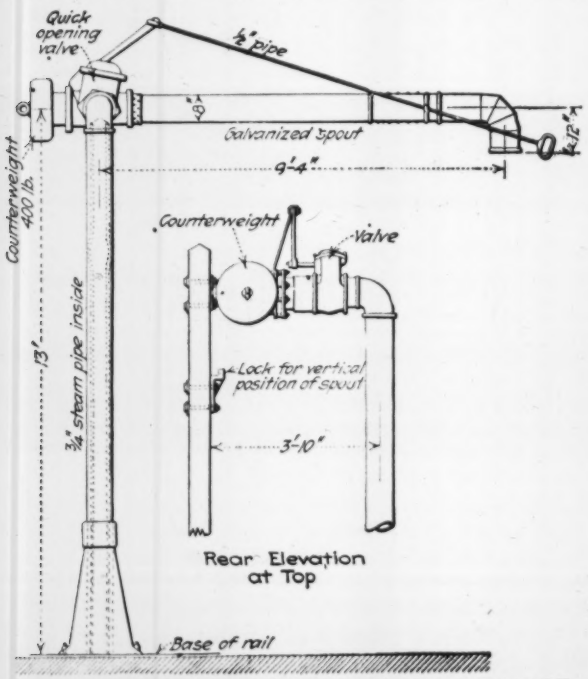



FIG. 8. OIL COLUMN: MISSOURI, KANSAS & TEXAS RY.

end of the spout, this bucket being swung up (and thus emptied) when the spout is spotted over the tender. The gravity flow from the 6-in. spout is at the rate of about 250 gal. per min., varying with the temperature and the amount of oil in the elevated tank, so that the average 2,500-gal. tank of an engine tender can be filled in about ten minutes. An average of eight engines take oil at Cypress daily, with about 1,500 gal. to each engine.

In the National oil column used by the Missouri, Kansas & Texas Ry. (Figs. 6 and 8) the spout swings vertically instead of horizontally. The 8-in. column or stand-pipe, having a loop of steam pipe within, carries a horizontal arm parallel with the track and having a revolving elbow whose other end is journaled in a timber post. To the track side of the elbow is attached the 8-in. sheet iron spout, a 400-lb. counterweight on the back of the elbow returning the spout to its normal

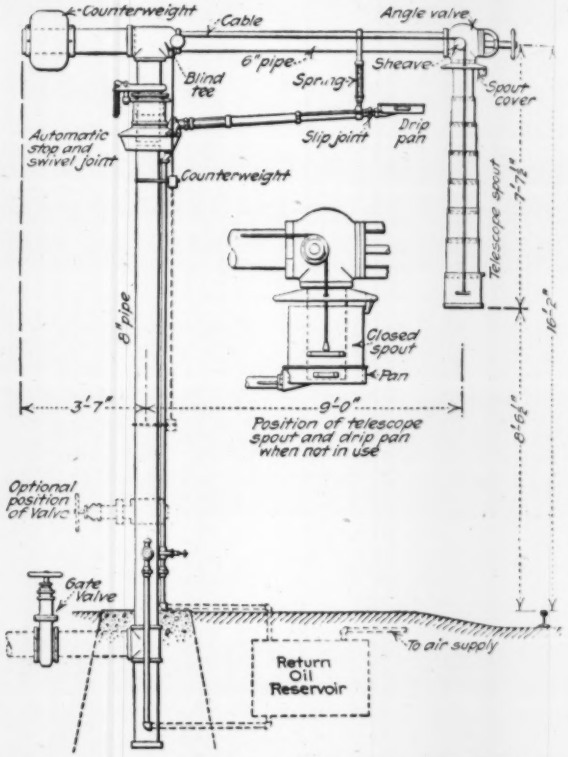



FIG. 9. OIL COLUMN: LOS ANGELES & SALT LAKE RY.

vertical position after use, so that there is little dripping of oil. A spring lock or latch holds the spout in this position, to secure it against wind pressure. A rod along the spout enables the fireman on the tender to operate a quick-acting valve in the horizontal arm. With gravity flow from an elevated service tank the 8-in. oil column discharges at the rate of 400 gal. per minute, so that a 3,000-gal. tender tank can be filled in about 7½ minutes. With the pumped supply, the discharge from the oil column is about 200 gal. per minute.

The Los Angeles & Salt Lake Ry. has used an oil column somewhat similar to that shown in Fig. 6, but it is now using the Rose design shown in Fig. 9. An 8-in. vertical pipe carries a 6-in. horizontal arm with a valve in the outer end and a 6-in. telescopic vertical drop or discharge pipe, which is closed or held up normally by a chain and counterweight, being pulled down

only to enter the tender manhole when the engine is taking oil. When the oil column is not in use, the horizontal arm is swung round parallel with the track, and a telescopic drip pipe is pulled out so as to bring a drip pan under the spout. A down pipe for the drip is carried inside the 8-in. oil pipe and may be connected to the main or to the reservoir.

Measurement of oil delivered to the engines is made usually by means of a stick graduated in inches and gallons, the height of oil in the tender tank being noted before and after filling. Each engine is supplied with a stick for this purpose. In some cases a meter is placed on the pipe line leading to the oil column.

Design and installation of oil station facilities are under the direction of the engineering department as a rule, their operation and maintenance being in the hands of the mechanical department.

## Comprehensive Water-Works Plan for Cedar Rapids

REMOVAL of the water-works plant of Cedar Rapids, Ia., to a new site across the Cedar River, new filters, pumps, power plant and an expanded distribution system are recommended in a recent report by Burns & McDonnell, consulting engineers. The present plant and equipment are inadequate for present needs and a water famine is imminent, in their opinion, unless temporary relief is provided. Two 30-ft. diameter wooden coagulation and settling tanks and four 15-ft. diameter wooden filter units are recommended as a temporory expedient. The cost is estimated at $25,000 but one half of the investment can be salvaged and utilized in the new plant.

The Cedar Rapids plant was built by a private company in 1875 and bought by the city in 1903. Emergency piecemeal construction has added new boilers, pumps and filters. This resulted in a plant inadequate for present needs, difficult to expand or remodel, and with high operating costs. The plant is surrounded by important industrial properties and natural barriers which make it impossible to secure the necessary room for settling basins, storage reservoirs or purification works. The pumps are 25 to 30 years old. The equally old wood tub filters show decay. They are expensive to operate because there is no preliminary sedimentation or coagulation of the high-turbidity river water. With no storage reservoir the pumps must respond to consumption, resulting in inefficient operation during periods of low consumption as well as at high rates when old low-duty pumps must be pressed into service. Quoting now from the report:

Four supplies were considered: (1) McLeod's spring, which is hard and insufficient in quantity; (2) Indian Creek, which carries barely enough water for present demands and is badly polluted; (3) artesian wells, which produce a hard water and an adequate quantity for the present; (4) Cedar River, which is ample in quantity, comparatively soft, but subject to surface pollution and the sewage of Vinton, 40 miles away, and Waterloo, 75 miles away. Only wells and the river were seriously considered. The uncertainty as to the quantity eventually obtainable from the wells and the larger cost over the river water for treatment to bring the well water to an equal softness with the river water, threw the decision in favor of the latter. By filtering the soft, though turbid river water the quality can easily be brought to the sanitary quality of the well water. The hardness is half that of the well water.

At the site of the present plant there is insufficient space for filters and ample settling basins. The plant is poorly arranged for expansion and more than half of the present equipment must soon be replaced. New filters would have to be located across 21 railroad tracks, increasing the low service pumping head by 30 ft. static and 5 ft. friction head, thus adding $2.50 to $3 per million gallons. At the new site proposed there is ample room for pumps, filters and basins and future extensions, accessibility of switch tracks, saving in low head pumping, and a chance to make the power plant and filter plant of fireproof construction. Remodeling the old plant would cost approximately as much as the construction of a new one.

Some of the factors assumed in the design of the proposed filter plant are as follows: A mixing chamber with a long baffled run in which the water travels ½ to 1 ft. per minute for 30 minutes will have a rated capacity of 9 m.g.d. needed for the maximum day's consumption in 1930 for an expected population of 63,000. The 1920 population was 45,566. Six hours is the retention period provided for in the settling basin for the 9-m.g.d. rate. The effluent from the six 1½-m.g.d. rapid filter units would be sterilized and then stored in a 3,000,000-gal. circular covered storage reservoir which it is proposed to locate in Bever Park, 160 ft. above the commercial district. With preliminary sedimentation it is held that the filters may be overloaded 25 per cent. The main features of improvement over the existing filter plants, one of which was built 25 years ago, and the other less than 10 years ago, are better facilities for handling coagulant, dry-feed machines, long mixing chamber which will reduce the coagulant applied by one-half, sedimentation basins to relieve the filters, to insure a better effluent and to reduce the wash water to one-fourth or one-fifth of the amount now used. A saving of $4.50 per million gallons is estimated from the reduced coagulant and wash water. A unique proposal is to utilize the flat slab roof of the storage reservoir for tennis courts, as has been done at Arkansas City, Kansas.

Of the total estimated cost of $1,248,180 the principal items are: Real estate, $75,000; 8-m.g.d. cross-compound Corliss high-duty pumping engine, $60,000; 9-m.g.d. filter equipment, $108,000; filter and head houses and basins, $152,375; intake, yard piping and sewers $30,000; pump house, $75,500; distribution extensions, $347,600; river crossing, $25,000; storage reservoir, $100,000.

## Experiments in Treating Wastes from Water Gas Plant

WATER gas wastes at Flint, Mich., have been treated experimentally with 1,500 lb. of lime per million gallons of waste as a coagulant. A satisfactory effluent was obtained from 2 hours sedimentation and filtration through a coke filter. The rate of filtration was 8 to 10 m.g.d. per acre through 24 in. of coke over which was placed 6 in. of coke breeze. The turbidity was reduced 95 per cent, color 90 per cent, oxygen consuming value 95 per cent and total solids to 100 p.p.m. There was left no visible trace of oil and only a slight taste and odor.

The normal waste contained 200 to 500 p.p.m. of turbidity, 500 to 1,500 total solids, 1,000 p.p.m. oxygen demand. Laxity in operation of the gas plant may produce an inky black waste having an oxygen consuming value of 1,800 p.p.m. and total solids of 11,000 p.p.m. Baffling was considered undesirable as the oil comes to the top best under the most quiescent sedimentation possible. After 2 to 3 hours plain sedimentation and filtering at the rate of 1½ m.g.d. per acre the coke filter became clogged in a few days with an oily, tarry material which penetrated to the bottom of the coke filter. The turbidity reduction was 75 per cent, the color none, oxygen consumed, 40 per cent and total solids 50 per cent. The effluent had a gassy odor and taste and retained some light oils. The experiments were carried out by J. R. Pollock, sanitary engineer, city engineering department, Flint, and reported by him in a paper presented recently to the Michigan section of the American Public Health Association.

# Sinking Substructure of Bascule Bridge Reconstruction

## Trunnion Piers of Dix Road Bridge at Detroit Replaced by Rectangular Frame Standing on Four 12-Ft. Square Shafts Sunk Eighty Feet Deep

IN REPLACING the foundations of the Dix St. bascule bridge at River Rouge in Detroit, safety of structure and continuity of both river and street traffic were preserved by building the new foundation around and separate from the old pier and abutment. Briefly, four deep column piers were sunk at the four corners of a rectangle embracing the old foundations. The tops of the new piers were connected by steel girders embedded in concrete onto which the bridge was lifted from the old pier and abutment. During construction, until the final change of support, the bridge operated on the original foundations.

pier carried 204,000 lb. and the counterweight trunnion pier carried 520,000 lb. Both piers were solid concrete on piles from 25 to 35 ft. long. There were 28 piles under the main trunnion pier. This gave a load per pile, including the weight of the pier of 18 tons, assuming buoyancy to be ineffective, or of 11 tons, assuming buoyancy to be fully effective on all portions of the pier below water. Under the same conditions the loads per pile for 35 piles carrying the counterweight trunnion pier were 13 tons or 12 tons.

These foundations were inadequate. They began immediately to settle and soon after construction the

FIG. 1. DIX ROAD BASCULE BRIDGE SHOWING ORIGINAL SUBSTRUCTURE

*Original Structure.*—As indicated by Fig. 1, the bridge is a Strauss bascule. It was constructed in 1912 by the Board of County Road Commissioners of Wayne County. At that time the location was in open country and the design adopted was typical of the country highway bridges of the time. Now this location is in the midst of an industrial concentration dominated by the new Ford Blast Furnaces, and River Rouge, only nominally a navigable stream in 1912, is slated by the U. S. War Department for widening and deepening to accommodate Great Lakes freighters. Ultimately, as the industrial development increases, a new bridge will be required, but for some years the old structure, with new foundations necessitated by the proposed deeper channel, will serve the traffic, and with its new substructure designed so as to form a part of the structure of the future larger bridge, its continuation in service was considered good economics.

The original bridge is 142 ft. long, with a movable arm of 112 ft. and an A-frame fixed span of 30 ft. carrying the counterweight truss and operating mechanism. It was designed for a live load of 2,000 lb. per lin.ft. with an 18-ft. roadway and two 5-ft. sidewalks outside the trusses. The substructure consists of the rest pier or abutment, a main trunnion pier and a counterweight trunnion pier or abutment. All dead load comes on by the main trunnion pier and the counterweight trunnion pier or abutment, and, neglecting wind loads, the dead load acts vertically at all times and is constant in amount for all positions of the movable leaf.

On this assumption of loading, the main trunnion

bridge had to be jacked up from 6 to 9 in. and concrete added to the bridge seats. The movement was greatest at the abutment or counterweight trunnion pier. Continued settlement would have necessitated some kind of reconstruction, but, with the decision of the War Department to deepen and widen the river, immediate action was compelled, and plans were begun in November, 1919.

*Problems of Reconstruction.*—Detroit stands on a deep bed of clay. In the Rouge River section this clay presents especially difficult problems wherever heavy foundations have to be built. It is a semi-liquid blue clay. Indicative of its unreliability are the failures of sewers and that of the Ford dock wall and the settlement of buildings of the Ford plant. The clay also transmits shock. In building the Ford plant the driving of piles some distance away caused continuous settlement of the bridge foundations. These naturally difficult conditions were complicated at the Dix Bridge by the necessity of devising a method of reconstruction which would keep the old foundations safe and not interrupt greatly either street or river traffic.

Borings indicated solid rock at a depth of 90 ft. below water level and above rock a 10 to 12-ft. layer of hard material, a kind of hardpan composed of sharp stones ranging from pebbles to boulders cemented by a well-graded sand mixed with clay. Above the hardpan was the blue clay. It appeared that any stable foundation must have its bearing on the hardpan; also it appeared that any method for obtaining this bearing must be one which would not induce vibration in the

old foundation nor cause the semi-fluid clay to squeeze out or shift position. Pneumatic caisson piers to hardpan best met the requirements of no vibration and an undisturbed natural soil. Their greater cost it was considered was balanced by the fact that they could be used as sub-piers for the foundation of a future larger bridge.

For the reasons stated it was obviously impracticable to sink caissons within the area covered by the existing structures. They would have to constitute sub-piers for supporting some form of girder construction which in turn would support the old piers or the bridge itself. In view of the great weights of the old piers, and the possibility that this weight might eventually fall on the new supporting arrangement, should the pile supports continue to settle, it was decided that the plan of reconstruction must be such that there would be no connection between the original and the new substructure. Furthermore, it was essential that this plan should recognize the necessity of jacking up the superstructure to correct the existing settlement and the further settlement bound to occur during the new caisson sinking operations. Because of the light construction throughout of the superstructure and especially of the floor system, the only points at which jacking could be safely conducted were at the bridge seats.

*Method of Reconstruction.*—The plan adopted provided that four 12-ft. square caissons were to be sunk

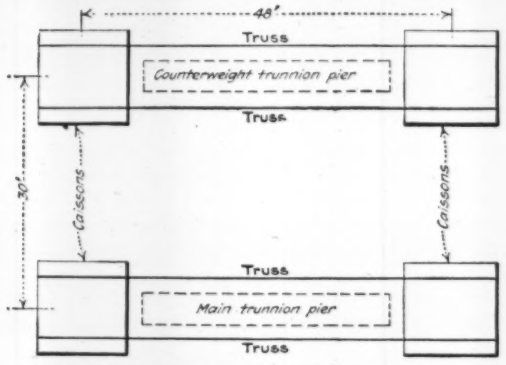



FIG. 3. DIAGRAM OF CAISSON LOCATION

80 ft. to hardpan to form sub-piers in line with and beyond the ends of the two old piers, as indicated in diagram by Fig. 3 and also by the view, Fig. 4. The plan at both piers was practically the same except in dimensions. At the river pier two steel trusses were designed one to be placed on each side of the original pier underneath the bridge, and spanning the distance transversely to the bridge between the two sub-piers. At their ends these two girders were securely braced together by heavy cross frames. The original pier being only about 4 ft. wide above water level, there was sufficient room on the top of the proposed 12-ft. square sub-piers to receive the end bearings of both girders, even allowing for a considerable variation in the final location of the sub-piers after sinking. All bracing between the top chords of the two girders was so designed as to clear the top of the original pier. This construction formed a steel frame around the old pier with the ends of the frame resting on the sub-piers. Embedded in concrete, the frames, with their connecting struts, appear as shown by Fig. 2.

During the sinking of the caissons the bridge set-

FIG. 2. RECTANGULAR FRAME ON PIERS REPLACING ORIGINAL SEPARATE PIERS

tled from side to side according to which pier was being sunk but at the completion of the four sub-piers it was found that the settlement had been consistent at each pier, resulting in a practically level condition transverse to the roadway. The bridge shoes at the counterweight trunnion pier were at this time over 17 in. below their proper elevation, 9 in. of which was due to former settlement and 8 in. due to settlement during the caisson work. The bridge shoes at the main trunnion pier were almost 6¼ in. below their proper elevation, 2 in. of which was due to former settlement and 4 in. due to settlement during the work.

Caisson sinking involved no unusual methods or experiences. Some of them settled considerably out of line but not enough so to prevent the placing of the girders. It was found, however, that the weight of the 12-ft. pier was just about enough to cause settlement through the clay when all pressure was released from the working chamber. On this assumption the frictional resistance of the clay was about 450 lb. per square foot of caisson surface.

FIG. 4. SINKING CAISSONS FOR NEW SUBSTRUCTURE

When the piers were leveled up and the girder seats were placed, it was found that the settlement previously noted made it impossible to place the girders until the bridge was jacked up. Jacking was begun first at the counterweight pier. Two jacking brackets, Fig. 5, were riveted to the vertical members of the A-frames directly over the pier seats. At each of these brackets two 60-ton jacks were used. A timber frame, Fig. 5, was constructed as a jacking frame under the counterweight itself and four 50-ton jacks were placed under this frame. Jacking on all eight jacks proceeded simultaneously, and the shore end of the bridge was raised

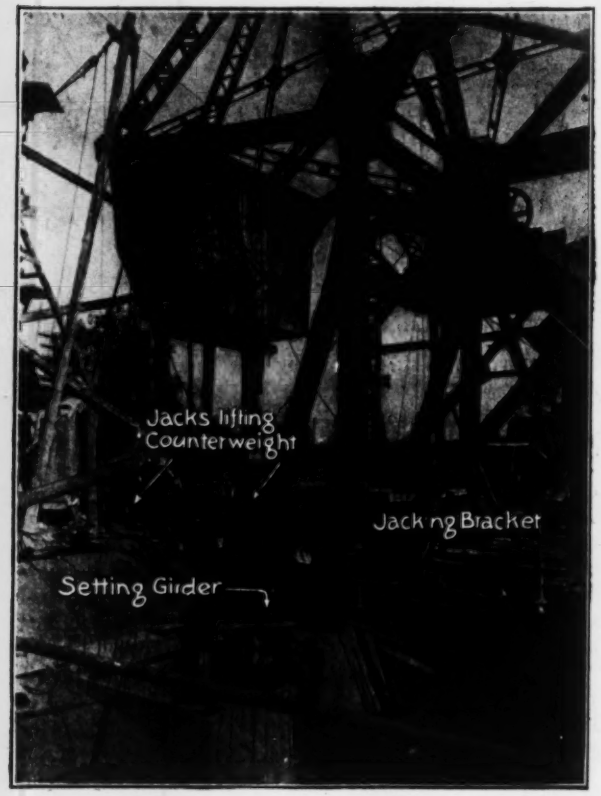



FIG. 5. JACKING UP SUPERSTRUCTURE AND PLACING GIRDERS

to its proper elevation. This work was closely followed up with blocking and wedges on the counterweight trunnion pier. About twenty hours of continuous jacking was required. All jacking was done with the bridge in the closed position. The supporting trusses were then erected and riveted up completely before any other work was allowed, thus securing that end of the bridge and carrying its load to the sub-piers.

During the jacking just mentioned the bridge shoes on the river pier, as was to be expected, tipped up on edge and the nuts had to be released from the anchor bolts. The next operation was to jack up the bridge shoes at the river pier (the main trunnion pier). For this purpose slots were cut through the pier under the shoes to allow two jacks to be placed under each shoe and the jacking was done from these points only. In the meantime, in order to provide against any mishap, which might occur at the bridge shoes of the counterweight trunnion piers because of the tipping of the shoes during the jacking of the river pier, the 60-ton jacks under the jacking brackets were again placed and put under about half the strain. It was figured that the wood blocking between the head of the jack and the jacking bracket would so shape itself by crushing as to insure safety.

After the supporting trusses were in place and riveted up at the river pier also, the old piers were demolished to a sufficient depth to clear all new work. At this stage the bascule was supported entirely on the supporting frames between sub-piers. Forms were placed on the outside of the trusses and a massive concrete girder was poured which enveloped the entire steel frame. This, together with the pouring of heavy reinforced struts longtudinally between the sub-piers completed the foundation work.

*Cost-Plus Contract Employed.*—Bids were received on Feb. 10, 1920, and the contract was awarded to the Missouri Valley Bridge & Iron Co. On April 1 material for the work began to arrive and the contractor began setting up his plant. On June 2 the first batch of concrete was poured in the first caisson and on Aug. 28 the last of the four caissons was sealed. The work was completed in November.

When the work was advertised it was certain that it could not be let on a lump sum basis. The uncertainties in cost of materials and labor, and in the supply available, were such that no contractor capable of handling this class of work would take a chance. The work was therefore advertised under a form of cost-plus-a-sliding-scale-fee contract. Contractors bidding on the work were required to name an estimated cost which included plant rental. It was agreed that the county would pay the actual cost of the work plus a fee of $20,000, provided the actual cost did not exceed the estimated cost. If the actual cost should exceed the estimated cost, one-half of such excess was to be deducted from the fee until it became a minimum of $5,000. On the other hand, if the actual cost was less than the estimated cost the fee was to be increased by half of the saving. The contractors estimated the cost at $110,000. The actual cost was $113,450 and this, plus the resulting fee of $18,274, made a total cost to the county of $131,725.

Both the progress and the cost of the work were greatly influenced by labor difficulties, freight tie-ups and trainmen's strikes, which occurred in the interval. The average rate for laborers was 75c. and for carpenters 90c. Sand hogs were paid $1 to $1.25 per hour. Cement, fortunately, was secured by the county at the low figure of $2.02 net, f.o.b. Detroit. The fabricated steel trusses cost 8c. per pound; reinforcing steel 5c. per pound; coal $3.50 and $9 per ton, and lumber $78 per 1,000 ft.b.m. Gravel cost $1.10 f.o.b. pit with 90c. freight.

The work was carried out by the Board of County Road Commissioners, Wayne County, Edward N. Hines, chairman. Design and construction were under the direction of H. A. Shuptrine, bridge engineer for the Commission.

## Will Test Hollow Brick Walls for Crushing Strength

The "Ideal" brick wall, advocated by the Common Brick Manufacturers Association of America, a hollow wall constructed of inner and outer courses of brick tied across by headers, is to be tested for compressive strength by the Bureau of Standards at Washington. Four sections of such wall have been built and are shortly to be tested, it is announced by the Bureau.

# Normalcy Shunned in Design of Engineers' Club-House

## Fancy's Flight Reaches New Heights in Plans for Providence Society's Home

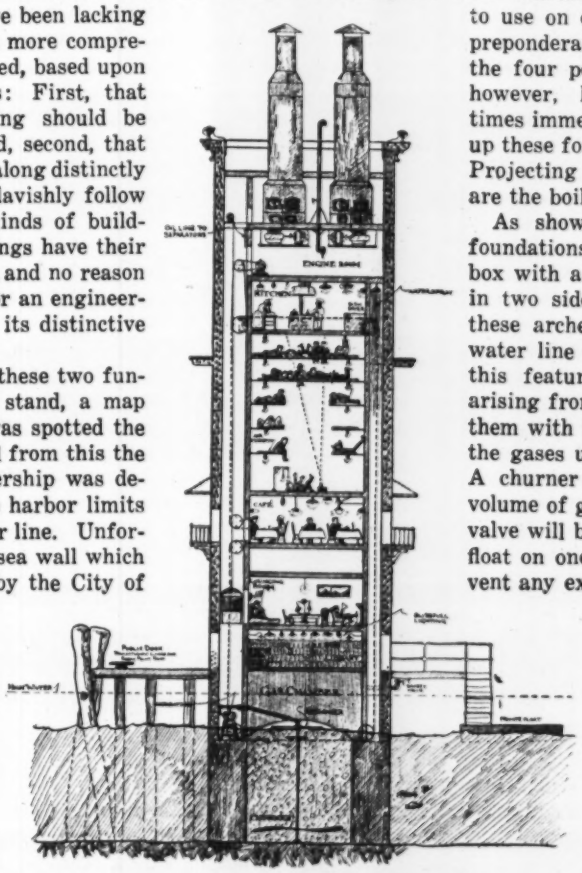
By Warren B. Lewis
Providence Engineering Society, Providence, R. I.

[*From time to time many plans for engineers' club houses have come to the attention of the editors, but the plan here described is thought unique, in the sense of Webster's definition: "Being without a like or equal; single in kind or excellence."*—Editor.]

MANY PLANS for a permanent club house which would serve not only as a gathering place for the presentation of technical papers, but also for all-around social purposes, have been considered for the Providence Engineering Society, which so far in its history has not been able to enjoy such facilities. Since the various plans presented seem to have been lacking in one respect or another, a more comprehensive plan is here presented, based upon two fundamental principles: First, that the location of the building should be mathematically correct; and, second, that its general design should be along distinctly engineering lines and not slavishly follow the architecture of other kinds of buildings. Other types of buildings have their own distinctive architecture, and no reason exists why the club house for an engineering society should not have its distinctive features as well.

Deciding, therefore, that these two fundamental principles should stand, a map was prepared upon which was spotted the location of each member and from this the center of gravity of membership was determined, falling within the harbor limits and practically on the harbor line. Unfortunately this spot is on the sea wall which was built a few years ago by the City of Providence, and a slight deviation from the first principle was decided upon by moving the site directly across the harbor where the tidal waters are free to rise and fall upon what was once the scene of the clam-digging industry.

This site is in desirable proximity to some of our more important industries; viz., the Gulf Refining Co., the Providence Gas Co., and the precipitation tanks of the sewerage system of the City of Providence. Borings were made, and it was found that the natural bottom was of a porous, plastic, impenetrable material, apparently of animal and vegetable origin, and capable of supporting any load which could possibly be placed upon it. The matter of foundation, therefore, was found to be a simple one, requiring no great expense in the matter of caissons, cofferdams, etc. It was also noted that considerable quantities of gas were continually arising, presenting certain possibilities, further mentioned.



AN ENGINEER'S "CASTLE IN SPAIN"

Without going into unnecessary detail at this point, attention is directed to the elevation of the building proposed.

The area and height of the building were carefully determined after considering the cost per sq.ft. and per cu.ft. and it was found that a building rather small in area but of considerable height was correct for this particular location. A dock is located on one side of the building, at which river steamers may tie up, and a float on the other side for canoes and row-boats. About midway of the height of the building is an automatic slide rule which can be read by mariners coming up Narragansett Bay and which will indicate the depth of water in the harbor and the locations of boats already anchored there. Around the top of the building is a frieze with figures indicating Rhode Island industries; viz., a dumb-bell, a fish, a clam, a shuttle, a caliper, a bolt of cloth and a warp beam. At the corners of the building are four searchlights which it was intended to use on election night to indicate the preponderance of votes for any one of the four political parties. As the city, however, has been Democratic from times immemorial, it was decided to wire up these four searchlights on one switch. Projecting from the top of the building are the boilers, further described.

As shown in the cross section, the foundations take the form of a square box with a flat slab on top, with arches in two sides of the box. The tops of these arches will be slightly above the water line at low tide. The purpose of this feature is to impound the gases arising from the river bed, and compress them with the rising tide, so as to force the gases up to the top of the building. A churner is provided to increase the volume of gas, if necessary, and a safety valve will be noted protruding under the float on one side of the building to prevent any excess of pressure which might be an element of danger to the stability of the building. Floating on the surface of the water within the chamber is a skimmer to collect oil on the surface and deliver it to a battery of centrifugal separators from which the oil will be taken and pumped to the boiler room which is on the top floor.

Immediately above the gas chamber is the library. The unique feature about this is that there is no doorway leading into the library, because the latter is never used anyway and it seemed an element of unnecessary expense to provide an opening. In the library will be noted the various forms of lighting units which are so extensively advertised and which, it is thought, could be very well put away where they would be of no annoyance to the membership.

Above the library is the lounge room. The distinctive feature about this is that there is plenty of natural light, but the artificial light consists of one 10-watt lamp. This was done to discourage the use of the lounge

room during the evening when technical papers are being read in the auditorium.

Above the lounge room is the café, in connection with which attention is called to the kitchen, two floors above. Food, as prepared, will be brought down on a conveyor alongside the elevator shaft and delivered into the café. The dishes, having been used, will be placed on this same conveyor which passes down into the chamber beneath the library, thence through the water to receive their first flushing, and up on the other side of the building in a hatchway down which a spray of water will be continually falling. This will thoroughly wash the dishes, which will then pass into the kitchen, through a dryer, ready for use again.

Above the café is the auditorium. This perhaps is the *most* unusual feature in the building. An auditorium sufficiently large to accommodate the membership as usually seated could not be provided in this building. Therefore it was decided to arrange a series of shelves running around the sides of the room, entrance being had to these from the elevator shaft. The members will get off at one or the other of these shelves or balconies, and will lie prone on cushions, and look over the edge toward the floor. The speaker of the evening will lie on his back, and thus will the relative positions of speaker and listeners be the same as in an auditorium arranged along more conventional lines. If the speaker is not entertaining the listener may turn around and hang his feet over the edge. When more feet than heads are visible, the speaker will know that it is time to desist.

Above the kitchen is the engine room. To conserve floor space the generators, which are directly coupled to internal-combustion engines, are suspended from the ceiling. These engines will use the gases which are accumulated in the foundation chamber. After a careful analysis it was found that the most reliable unit that could be used was the famous Ford twin-two engine.

Above the engine room is the boiler room. After due consideration it was decided that the Manning boiler was the most efficient boiler that could be used for heating and live steam uses and that it would lend itself particularly well to the floor space available. In order not to increase the height of the building unduly, it was decided to let these boilers project through the roof. It will be noted that the water gages and glasses which might seem to be in an inconvenient position are really not so by reason of the periscope which extends down into the engine room and through which the engineer can observe the water level at all times.

When the expense of running this building was figured, the designers were well satisfied with the cost of heat, light and power by reason of the free fuel available. However, they found that the café presented the usual difficulties; viz., that overhead expense is always too great and that this particular department would probably be a constant loss. You will note the space above the lounging room and immediately below the café. This space allows the overhead to be put underneath, thereby eliminating the one disconcerting element of expense.

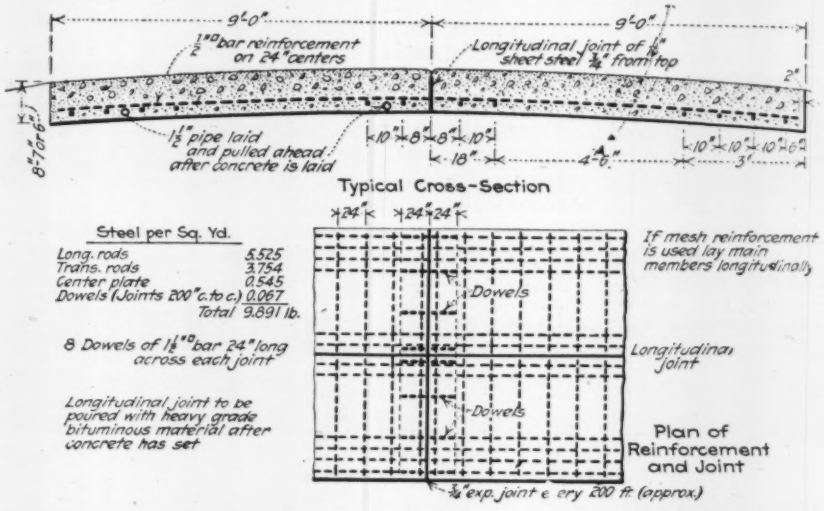
There are many minor details which have yet to be worked out, but, in the main, it is hoped that this plan, which was the result of a great deal of serious thought, will not have to be materially altered.

# Strengthen Concrete Paving Without Increasing Cost

## In New Design of Concrete Slab Steel Plate Longitudinal Joint Is Used—Thickness Uniform for Entire Width

By B. H. Wait
District Engineer, Portland Cement Association, New York

In THE past considerably more study has been given to the mixtures, the surface and the riding qualities of the concrete road than has been given to the question of strength. The present practice with mixtures of 1:1½:3, 1:1½:3½, 1:2:3 or 1:2:4, depending upon the quality of sand and coarse aggregate, has shown us that we can obtain a lasting and satisfactory surface and excellent riding qualities if proper attention is given to the amount of water, time of mixing, manipulation, forms, etc.




DESIGN OF CONCRETE PAVING SLAB WITH LONGITUDINAL SHEET STEEL JOINT

In THE past considerably more study has been given to the mixtures, the surface and the riding qualities of the concrete road than has been given to the question of strength. The present practice with mixtures of 1:1½:3, 1:1½:3½, 1:2:3 or 1:2:4, depending upon the quality of sand and coarse aggregate, has shown us that we can obtain a lasting and satisfactory surface and excellent riding qualities if proper attention is given to the amount of water, time of mixing, manipulation, forms, etc.

With the above points in design and construction developed satisfactorily, the point in concrete road construction which requires attention is the strength to resist impact and bending moments caused by loads, frost action and weak subgrade. Up to date practically all concrete roads have been built monolithic for the full width of the roadway, a small amount of reinforcing metal being placed in some cases in order to hold the cracks from opening up. The roads also have been built thicker in the center with the idea that this greater thickness was needed at the center of the long beam. In such construction there has been some center cracking, some transverse or diagonal cracking, some breaking down of corners, and some wear at the joints and cracks if proper maintenance was not given.

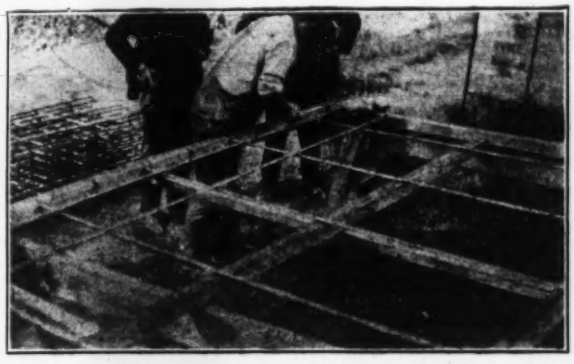
As an improvement over former practice the design shown in the accompanying drawing and described

below has been developed. It provides for the following features:

(1) The construction of a center joint, either plain as shown in the drawing or with corrugations or keys to prevent lifting of slabs one above the other, thus dividing the slabs into 8, 9 or 10-ft. spans instead of 16, 18 or 20 ft., as are now being used, and doing away with the possibility of center cracking.

(2) The use of transverse reinforcement sufficient to eliminate longitudinal cracking in the short span sections. (In many cases it has been necessary to build concrete roads in half width in order to take care of traffic during construction and these roads have never cracked longitudinally when built of plain concrete). The reinforcement proposed should be sufficient to take care of any traffic conditions which develop in the future.

(3) Longitudinal reinforcement placed in such a way that traffic at all times will be travelling on a reinforced concrete beam of sufficient strength to carry the load without failure, to do away with transverse or diagonal cracking and to allow the elimination of joints, except expansion joints about every 200 ft.



WIRING STEEL BARS INTO MATS ON WOOD FRAME

(4) Placing of this reinforcement in the bottom of the slab where it will act to support the loads over weak places in the subgrade and so that it will allow the placing of all the concrete in one operation which should result in a better quality of concrete than can be obtained if the concrete is laid in two layers with reinforcement placed after the first layer is down.

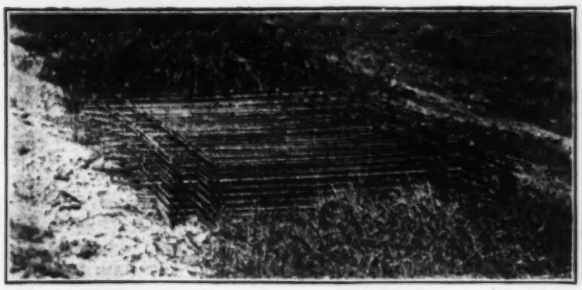
(5) Placing of steel dowels at joints in order to reinforce the corners and in order to keep one slab from riding above the other. In bad subgrades it will probably be advisable to place additional corner reinforcement on the top of the slab.

In place of a 6-8, 7-9, or 8-10-in. unreinforced or lightly reinforced pavement, as now generally laid, it is proposed to lay a uniform thickness of 6, 7 or 8 in. of concrete reinforced according to the proposed plan. By laying the center joint no point in the pavement need be stronger than the edge and the money saved (1½ in. of concrete) by making a uniform thickness of pavement will be sufficient to place the 10 lb. of steel rods per square yard as shown on the plans or a slightly smaller amount of heavy steel mesh.

### Analysis of Cost

A thickness of 1½ in. of concrete costs approximately $0.40 per square yard in plain concrete road.

A thickness of 1½ in. of concrete plus ¼ lb. per square foot of steel reinforcement, as commonly used, costs $0.55 per square yard in lightly reinforced concrete road.



STEEL REINFORCING MATS STACKED AT ROADSIDE

Steel rods can be obtained f.o.b. New York, New England, Pennsylvania, New Jersey or Delaware for about $0.0215 per pound, or the 10 lb. for $0.215 per square yard. They can be unloaded and hauled to the job for a maximum of $3 per ton or $0.0015 per pound or 1½c. per square yard for the 10 lb. A contractor laying 300 ft. of road per day will lay 6,000 lb. of steel. This can be handled by a maximum of three men at a cost of $15, or ¼c. per pound or 2½c. per square yard. Thus for 10 lb. of steel per square yard the total cost is $0.295.

It therefore appears that 10 lb. of steel rods per square yard or a smaller amount of heavy mesh per square yard can be laid with the proposed design at no increase in cost and in some cases at a material decrease in cost over present practice.

---

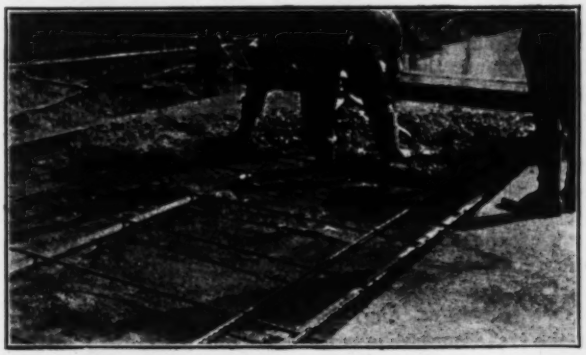
[*Reinforced-concrete highways of the same general design as that outlined above by Mr. Wait have been constructed this season by the highway division of the Massachusetts Department of Public Works. A description of the methods used by the contractor on one of these jobs is contained in the article which follows*—Editor].

---

## New Design Reinforced-Concrete Road Built in Massachusetts

By Walter S. Edge
Chief Engineer, Concrete Steel Co., New York

A CONCRETE slab of moderate thickness heavily reinforced, rather than a thicker slab of plain concrete or concrete reinforced only with a light mesh, was used this season by the Massachusetts Department of Public Works, through the division of highways, on the



IRON PIPES HOLD STEEL IN PLACE DURING POURING OF CONCRETE AND ARE THEN REMOVED

main road between Springfield and Worcester in the town of East Brookfield, included in federal-aid project No. 40. This road is slightly more than a mile in length, 20 ft. wide, is on practically a level grade and is located on a tangent. It was constructed in two halves, separated by a longitudinal construction joint down the center.

The slab is heavily reinforced with ½-in. square deformed bars. The transverse bars are spaced on 2-ft. centers, while five longitudinal bars are used in each half section of the road. Along the longitudinal center joint are placed dowels of ½-in. square deformed bars which are bent back against the face of the completed slab to facilitate the construction of the adjoining section, but which are later straightened out to bond the two halves together. The face of the joint is painted with tar before the casting of the second section. By this construction it is believed that either the edges on the center of the road may move a slight amount vertically without causing cracks in the surface of the slab and a definite longitudinal joint is formed down the center of the road which tends to separate traffic going in opposite directions.

The contractor's methods are simple and appear to be giving excellent results. The reinforcement is delivered along the grade by truck and is assembled in a wooden frame by one laborer. After wiring the intersections the mats, which are 14 ft. long and 9 ft. 10 in. wide, are piled alongside the road. When the concrete mixer has completed a section and has backed away in readiness to cast another section, a laborer adjusts three 1¼-in. pipes which rest on the subgrade and serve as a temporary support for the reinforcement. Two men pick a mat of steel off the pile and place it in position in the road resting on the three pipes, lapping the longitudinal bars about 1 ft. with those of the preceding section. The concrete is immediately deposited and worked in around the steel with shovels and the pipes are slid back under the mixer as the concrete advances. The surface of the road is screeded, rolled with a light roller, worked with a canvas belt and later roughened with a broom.

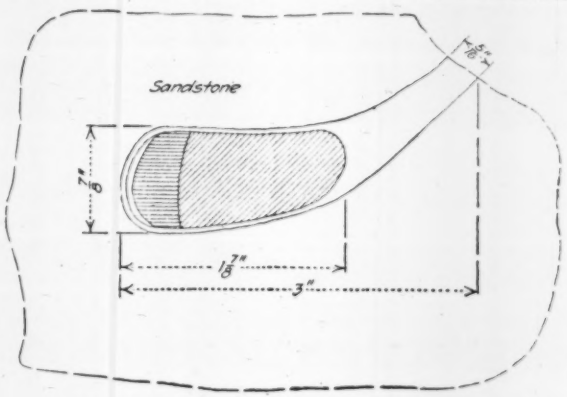
Transverse construction joints are made every 120 ft. and a ½-in. felt filler is used. These joints are dowelled across with plain bars which are painted with asphalt to destroy the bond.

The progress of the work is satisfactory, a gang of 35 men laying an average of 410 lin.ft. of 10-ft. road in 10 hr. With the type of reinforcement used it is not necessary to bring the concrete to a predetermined grade before placing the steel. One laborer is able to fabricate the steel required for this crew and while the contract price for the reinforcement in place is 5½c. a pound, the actual cost is considerably less than this. While the reinforcement used is unusually heavy, weighing about 1 lb. per square foot of surface, the slab thickness, 6 and 7½ in., is below that which is customary. The engineers of the highway division reasoned that the concrete saved by using the thinner section would partly, if not completely, offset the added cost of the steel, while the resulting roadway would unquestionably be superior to the plain concrete slab of 1 in. greater average thickness.

One feature of this road which appeals very strongly to the traveling public is the opportunity that it gives to use first one half and then the other, and in this manner either to avoid completely or at least minimize the use of detours. The work is being done by Carlo Bianchi & Co., Inc., of Framingham, Mass., under the directions of the Division of Highways of the Department of Public Works of Massachusetts, of which A. W. Dean is chief engineer.

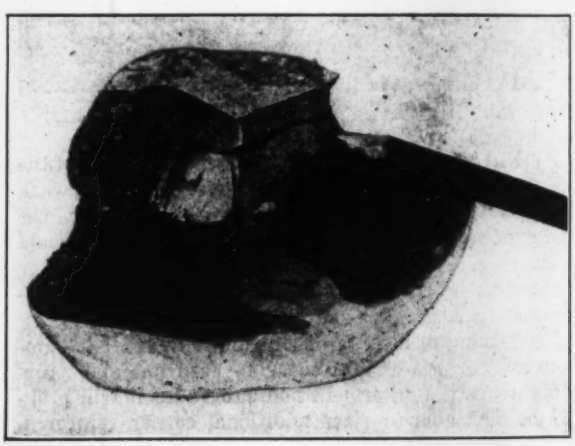
## A Marine Borer that Thrives on Sandstone

A SPECIMEN of pholas or marine borer that burrows in stone, which had grown 1⅞ in. long in a burrow 3 in. long in hard sandstone, was recently found near Punta, Cal., by W. H. Kirkbride, engineer, maintenance




SKETCH SHOWING DIMENSIONS OF ROCK BORER SPECIMEN

of way and structures, Southern Pacific Company. In boring this distance the mollusk had grown from ⅛ in. to ⅞ in. in diameter. The specimen was found near the high tide line in a rounded stone about the size of a



BROKEN SANDSTONE PEBBLE WITH EMBEDDED MOLLUSK

man's fist. The stone contained the marks of a number of borers other than the one shown in the accompanying illustration, whose dimensions were readily taken after the rock had been broken open.

## Steel Little Affected by Varied Rolling Conditions

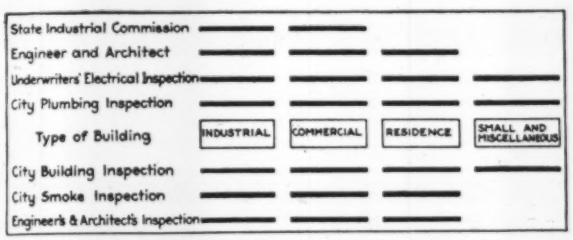
Studies of medium-carbon steels produced under a wide variety of rolling conditions at the Bureau of Standards indicate that rolling variations have little effect on the mechanical properties of the resulting rolled steel. The difference in properties between transverse and longitudinal specimens from the same plate was as great as the variations caused by rolling.

# Municipal and Private Building Inspection

## Study of Conditions in Rochester—Diverse Codes and Inspection Services—Centralization of Authority and Better Definition of Function Desirable—Utilizing Private Inspection Effectively

By Frank P. Cartwright
Assistant Engineer, Bureau of Municipal Research, Rochester, N. Y.

CO-OPERATION between public and private agencies for the control of building inspection, though desirable from the community point of view, necessarily is complicated by differences in the purposes which animate these agencies. The benefits to be secured through inspection of building construction are so real and important, however, and the facilities usually provided for city inspection so inadequate to the demands upon them, that every possible means should be taken to organize the various inspection agencies and to utilize them to the fullest extent for the protection of community and individual interests. The following discussion of conditions in Rochester, N. Y., and of the measures taken to insure good building construction, indicates some of the methods by which this may be done.




DUPLICATION AND OVERLAP OF BUILDING INSPECTION SERVICES IN ROCHESTER

There may be distinguished three general situations which occur in connection with inspection of building construction:

1. Inspection by municipal or local agencies, financed from public revenues, under governmental control, taking their authority from the police power, and enforcing set codes enacted by the local authorities.

2. Inspection by privately financed agencies, not acting under contractual relations and not backed by the police power, but securing the enforcement of a set code through control of some utility necessary to the builder.

3. Inspection by engineers or architects acting in a contractual relation for the enforcement of specifications which are purely matters of agreement between owners and builders.

The work of the second and third groups necessarily helps in great part to protect and promote the public safety and welfare, but it is essentially different from that of the first group in that the regulations enforced are not directly under public control. There is no inherent guarantee that requirements will be sufficiently strict, and, in the case of the second group, none that they will not be unnecessarily so, to insure the degree of safety and structural excellence which the community believes desirable. It also happens usually that through the duplication of agencies and the overlapping of work, building construction carries altogether unnecessary overhead charges for inspection service.

A study of the situation in Rochester shows the need of co-operation and reorganization of the three types of building inspection in order to realize the utmost benefit from the means at hand. The various organizations concerned, together with their respective fields and duties, are shown in a table on p. 196. There, of course, are still others charged with protection of health, prevention of boiler explosions, etc., but this discussion is limited to inspection of construction work. It will be noted that the inspection work carried on under city auspices is divided among three agencies, and that in addition to those of the city the governmental agencies include that of the State Industrial Commission, which regulates conditions of employment and certain features of factory construction. The insurance agencies inspect practically all electrical work which receives any inspection whatever, and a good part but not all of the elevator installations. Engineers and architects retained by the builder inspect a part but not by any means all of the more important building construction. The relative scope of the work done by each agency, and the degree to which the various fields overlap, are shown graphically by the adjoining diagram.

### Analysis of Situation

It is obvious that if each of the agencies listed is carrying out it duties faithfully within the nominal limits of its field, there are at least three and often as high as six inspection agencies whose requirements must be satisfied in connection with the building of one structure. Four of these enforce well-known codes, one is concerned only with the building contracts and specifications, and one with more or less independent and arbitrary requirements set up by the various insurance agencies. If smoke inspection is to be extended to control design and construction of fuel burning installations, as is necesasry if it is to produce anything like worthwhile results, a seventh agency will be added to those mentioned.

It is at once apparent from the diagram that the city services themselves are decentralized and should be brought together for more efficient administration. The State Industrial Commission and the engineering and architectural inspection parallel the city service in a great number of cases, though concerned with matters differing very little from those dealt with by the building code. The problems of organization, therefore, are (1) to centralize city building inspection, (2) to define the limits between the fields of the city inspection agencies and the State Industrial Commission, and (3) to utilize the private inspection agencies, so far as possible, to supplant the city work.

There also is the question, depending on factors mostly of local significance, as to whether electrical inspection should be a privately controlled service.

### Plumbing Inspection

According to a law affecting all cities in New York State, plumbing inspection is included in the duties of the local health authorities. With our present concep-

tions of public health work, such an idea seems highly fantastic, for the effects of faulty drainage in causing disease are known to be very small indeed. Whatever the original idea the plumbing codes now generally in effect have but the slightest connection with the activities of a public health unit as now carried on. The plumbing code of Rochester, like the building code, concerns only questions of materials, workmanship and type of fixtures. A plumbing inspector does not attempt to decide whether conditions are sanitary or not. He simply sees that the plumbing system is of an accepted kind, of proper materials and properly installed. This done, he goes away and forgets it until informed that it has broken down in some particular. Then he makes sure, as before, that the necessary repairs are made in a workmanlike manner. The plumbing inspector requires that a stack be of a given size; the building inspector makes sure that rooms have the floor and window area considered necessary to the health of the occupants. One is as much concerned with the public health as the other. Both are concerned with original construction only, and both should be in the Bureau of Buildings, which has the control of original construction for its object, not in the Bureau of Health, which is charged with the correction of unhealthy conditions.

It furthermore is not good management to put an inspection service concerned only with materials and workmanship under the inspection of a man trained in medical matters, whose attention is almost wholly taken up with fighting disease. It has resulted, in the case under discussion, in almost complete separation and independence of the inspection service.

The municipal health bureau is an organization whose purpose is the prevention and control of disease. Its annual appropriations almost always are inadequate, and it is unfair to that body and misleading to the taxpayers to support out of these appropriations, ostensibly for protection of public health, an inspection service concerned with protection of property values far more than with the prevention of disease. This practice is quite general in American cities, and seems to be a survival of the older public policy which puts property interests above human life or health. It is a neat and successful scheme for protecting property values with money the uninformed citizen naturally believes is being spent in controlling disease.

### Inspection of Electrical Work

Rochester is unusual among the larger cities in that all inspection of electrical installations is delegated to the Underwriters' Association of New York State, which enforces the National Electrical Code. By agreement with the local power company no service connections are made until the underwriters' approval of the installation has been expressed. Complete inspection of electrical work in new buildings therefore is ensured.

With a disorganized and inefficient city inspection service such as apparently has obtained in the past this probably has been productive of the best results, but as a general rule it is not good policy that this service should be performed and charged for by private agencies. Electrical inspection, fully as much as building inspection, involves the exercise of the police power, and to delegate the control of electrical work to a private agency and to make the supply of power to a prospective user contingent on the approval of that agency is in effect the same as though automobile insurance companies were allowed to draft and enforce a traffic ordinance, or as though enforcement of the building code were farmed out to private organizations. The fact that the code enforced by the underwriters is one almost nationally accepted, or the possibility that privately managed inspection may often be better than that subject to political influence, does not alter the principle that police activities involving the legislative and executive branches of government should be performed by the government.

In accordance with the foregoing views a charter amendment is being drafted which is to place plumbing inspection under the supervision of the Superintendent of Building Regulation and which will add electrical inspection to the duties of the present Bureau of Buildings. Smoke inspection, once a freelance activity nominally under supervision of the commissioner of public safety, already has been made part of the work of the bureau. It is expected that the clerical work now involved in this function will be performed by the bureau's inside men and that eventually plans of power and heating plants, submitted for the smoke inspector's approval, will be handled by the same clerical procedure as are building construction plans.

It does not appear practical under present conditions

BUILDING INSPECTION AGENCIES OPERATING IN ROCHESTER, N. Y.

| Title of Organization | Financed by | Authority to Enforce Rulings Based on | Nature of Inspection Work | Object of Inspection | Field of Work |
|---|---|---|---|---|---|
| Bureau of Buildings (Structural Branch) | City | Police power | Inspect original construction, alterations and additions | Protection of public safety and welfare, fire prevention | All building construction in city |
| Bureau of Health Plumbing Inspectors | City | Police power | Installations and repairs of plumbing | Public Welfare | All plumbing work in city |
| Smoke Inspector | City | Police power | On complaint, subsequent to construction | Protect public welfare through smoke prevention | All plants in city |
| State Industrial Commission | State | Police power | Both of original construction and periodically thereafter | Protect health, prevent accidents and fires | Industrial and commercial structures in city and adjacent districts |
| Underwriters' Association of New York State | Insurance companies | Insurance rate regulations | Inspect electrical installations | Prevent fires and accidents | Nearly all electrical work in city and surrounding districts |
| Elevator and Casualty Insurance Inspectors | Insurance companies | Insurance rate regulations | Inspect original installations and periodically thereafter | Prevent accidents | Elevator plants in city and surrounding districts |
| Architects and Engineers | Private parties | Terms of Builders' contract | Inspect original construction only | Enforcement of Builders' agreements | Construction work of all kinds |

to divide inspection of building construction between the state and city agencies. The state industrial code involves some building regulation, but mostly concerns conditions of labor. The city building code goes much farther than the state law in regulating materials, workmanship, etc., but contains no safety legislation to speak of. The obvious move would be to make the city inspectors responsible for features of construction, since they must cover the ground anyway, and to leave safety regulation and working conditions to state authority. Unfortunately the two codes do not agree as to what is safe building construction under the same conditions, and at the present stage of development of building regulation there is litle hope of getting them into agreement. There seems no immediate prospect, therefore, of effective co-operation between these agencies.

### Engineers and Architects

It is customary for building application forms to specify that all work involved in the operation must comply with the requirements of the building code. Beyond this they do not usually go, and the various possibilities of obtaining control of the work through private inspection agencies are not well developed.

In Rochester, at present, and in many other cities, no code requirement or department rule exists to prevent plans for a $100,000 building from being "prepared" and submitted for approval by any carpenter who has the confidence to undertake the project. It is of course easy to dispose of extreme cases of incompetency, but there are large numbers of would-be designers and architects with a commercial bent who are very ready to attempt work beyond their capacity and who often are employed on the basis of their ability to "slip something over" on the building inspectors. Their field inspection of structures for the construction of which they are retained is also very unreliable. Even reputable architects often delegate structural design to steel companies or to other agencies, thereby dispersing still further the responsibility for dependable work.

Under these conditions there is constant friction between the city's inspection force and unreliable designers and architects. In many cases it is necessary to supervise every step of the work if the city authorities are to be certain that the structure complies with the building code.

In order to raise the professional standards obtaining in this line of work; to prevent those insufficiently trained from attempting to handle important or complicated design; and to obtain better control over those on the border line, it is believed that municipal bureaus of building inspection should accept plans and applications only from those who have received licenses to present them. This, of course, would not need to apply to minor structures, such as sheds, garages, etc., costing less than about $1,000.

### Requirements for Licenses

The requirements as to training, qualifications, etc., which should determine the issue of licenses, are a matter of some difficulty, and there is great danger that the control over these would become a political asset in the hands of the chief of building inspection. It probably will be necessary, in order to get the best results from such a system, to provide for two grades, one open to all men licensed under the laws of this or other states to practice as engineers or architects, and the other authorizing men to present plans only for minor structures. To prevent injustice this latter class should be open to all applicants reasonably qualified until such time as they show themselves unreliable either as to details of plans or construction.

The element of control is secured through the authority of the chief of building inspection to revoke a man's license upon clear evidence of such unreliability. In order to prevent arbitrary use of this authority, action should be made dependent on the approval of a board of appeal, such as are becoming customary in connection with the enforcement of building regulations.

### Field Inspection

A good percentage of the larger building operations, and practically all those involving reinforced-concrete construction, need full-time inspection by competent men. It is not reasonable for owners to depend upon municipal inspection to guarantee the safety and structural excellence of such large buildings, and it usually is not possibly for city forces, with their limited facilities, to give such work the attention which it should receive, To ensure compliance with the code and with the plans and specifications approved by the city inspectors, full-time inspectors, paid by the owner and acceptable to the chief of building inspection, should be required on all such work. The city inspectors should keep in touch with these through occasional visits, and any evidence of unreliability on the part of the full-time man should affect his standing on the list acceptable for such work.

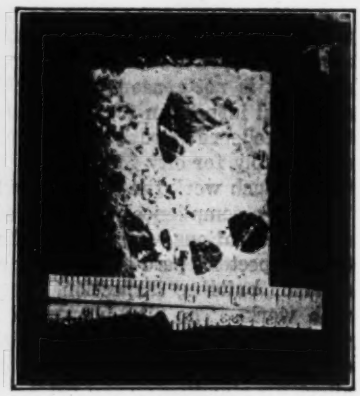
It appears that this method of controlling field work is more easily carried out, and less productive of labor troubles, than the plan, now in force in some places, of licensing contractors or contractors' superintendents. It does not provide in case of trouble for the suspension of work, which punishes the owner as well as the contractor, nor for the removal of an important figure in the work, which also disorganizes things temporarily. It unites the interests of the owner and the city inspection force, which interests really are the same. It puts on the work a full-time well qualified man who has the backing of both the city and the owner, and whose future really depends on the thoroughness of his work. In course of time it builds up a group of men which can give valuable assistance to the city forces in controlling building construction.

### Conclusion

The various methods of centralizing building inspection described in the foregoing have one general effect. They tend to increase the responsibility and authority of the city building inspectors and to further their control of private agencies of a similar nature. It will be urged that politics play too large a part in the personnel and policies of city building inspection agencies and that the measures suggested will but add to the political powers of such units without really effecting the benefits claimed. To a certain extent this probably is true, but it must also be remembered that the same things are true to a much greater extent of the uniformed police force. In spite of this there is a sound and steady tendency to add to the duties and responsibilities of the latter and to hold it accountable for performance. City building inspectors also act under the police power, and it is to the public interest not to disregard the services of which they are capable but to extend their field and increase their effectiveness, at the same time holding them to a greater accountability than at present.

## Portable Diamond Drill Cuts 4½-In. Cores from Concrete Pavement

A DIAMOND drill outfit with a bit cutting a 4½-in. core was recently mounted on a 2-ton motor truck and sent over 1,565 miles of California highway to get samples of the concrete pavement. Samples were taken three miles apart on an average, and were used in analysis of the condition of the concrete made by the United States Bureau of Public Roads. The drill, driven by a gasoline engine was mounted with the bit projecting over one side of the truck so as to be always ready for operation. The equipment complete, including a full 500-gal. water tank weighed 6,300 lb. In making a cut the bit was lowered to the pavement and guided by a wooden clamp consisting of two timbers placed on the road's surface, leveled up with shingles, and held in place by a jackscrew between the timbers and the frame of the truck. Water from the tank was forced down to the cutting edge of the bit to keep the carbons cool and free from cuttings. About 30 gal. of water per cut through a 4-in. pavement was required.



SAMPLE CORE FROM 5-IN. PAVEMENTS

Cuts were made without difficulty through both ½- and ¾-in. reinforcing steel as well as through ¼-in. wire netting. The chief difficulty in cutting was met in working through cracks in the concrete hidden by the thin layer of asphalt on the surface. The average throughout the work was about eight cores per day. The actual number of cores taken ranged from three to thirty, although at the latter rate it was not possible

DRILLING RIG

to make the average distance of 3 miles between cores. When set up ready for drilling, an average of about fifteen minutes was required for cutting through 4 to 6-in. of concrete. Additional weight in the truck would have been of some advantage at times.

The drill was made by the Diamond Drill Contracting Company of Spokane and operated under contract by the Diamond Drilling Co. of San Francisco.

## The Oklahoma City Sewage-Works Problem and Report

### City Will Inform Electorate for Fall Election—Abstract of Report of Consulting Engineers Gives Units

TWO years from Nov. 13, 1920, Oklahoma City, by order of the State Board of Health, must cease polluting the streams into which it discharges its sewage. The plant installed must produce a non-putrescible effluent free from settleable solids, equivalent to that obtained by two-story tanks, aërating beds and secondary sedimentation. To interest as many civic organizations as possible in the solution of the question a sewerage board of nine members was appointed with the personnel selected by the organizations. H. E. Musson, an engineer representing the local chapter of the American Association of Engineers, was made chairman. Dr. J. F. Martin, city health commissioner; H. J. Darcey, state sanitary engineer, and B. M. Hart, city engineer, represented the city and state. The board selected Pearse, Greeley & Hansen, Chicago, as consulting engineers. Their report has been presented (see *Engineering News-Record*, p. 877, May 19), adopted by the board, presented to and accepted by the city commissioners. It is proposed to inform the people of the plan this summer before calling for a vote on the necessary bonds this fall. Briefly, the recommended system consists of an intercepting sewer of 60-m.g.d. capacity with sewage-works of 12.5 m.g.d. discharging into the North Canadian River to handle the combined domestic sewage and industrial wastes of the main city and packing house district, and a small system for domestic sewage only, discharging into Deep Fork, dry much of the time. For both districts settling tanks and sprinkling filters are recommended. Activated sludge was considered, but largely because of the high cost of maintenance that process was not advised. Estimates for eliminating the industrial wastes from the sewage were also presented.

Some of the assumptions made in in the report follow: Ten years hence, the period for which the designs were made, the population connected with the sewers will be 128,800; 111,300 in the North Canadian District and 17,500 in the Deep Fork area. A daily per capita rate of sewage flow of 50 gal. was estimated during dry seasons and 90 gal. during wet seasons. The stockyards waste will increase these figures to 74 and 125 gal., respectively.

In the estimates for ground water infiltration, gagings indicated 110 gal. per acre daily, equivalent to 22 gal. per capita, but this figure was increased in the light of data obtained from other cities. As a result of gaging and computations the mean in Toledo, Ohio, was 777 gal. per acre daily with a maximum of 1,200 gal. during spring conditions. At Decatur, Ill., an average of 400 gal. was found during wet weather. In Cincinnati, H. P. Eddy recommended 750 gal. Gagings in Milwaukee led to a decision to use 1,620 gal. as a maximum. At Fitchburg, Mass., Metcalf & Eddy used 139 gal.

PER CAPITA WET AND DRY SEASON FLOW COMPARED

| City | Wet Season, Gal. | Dry Season, Gal. | Ratio Wet to Dry Season |
|---|---|---|---|
| Bloomington, Ill. (5) | 167 | 84 | 2.0 |
| Decatur, Ill. (1) | 150 | 97 | 1.5 |
| Toledo, Ohio (2) | 146 | 106 | 1.4 |
| Boston, Mass. (3) | 151 | 89 | 1.7 |
| Framingham, Mass. (4) | 78 | 53 | 1.5 |
| Oklahoma City (1) | 68 | ... | ... |
| Deep Fork as gaged | 68 | 45 | 1.5 |
| Deep Fork as allowed | 90 | 50 | 1.8 |
| Intercepting sewer | 150 | 90 | 1.7 |

(1) From gagings by Pearse, Greeley & Hansen.
(2) From Report on Elimination of Sewage from Toledo's Waterways.
(3) North Metropolitan Sewer District Data from Metcalf & Eddy.
(4) Massachusetts State Board of Health.
(5) Data from Folsom and Taylor.

Sizes of the treatment plant were based on the following plant loadings: Fine screens of 20-mesh are needed as a preliminary to activated-sludge tanks. Imhoff tanks for domestic sewage should have a 3-hr. settling period, a sludge

capacity of 1.75 cu.ft. per capita and gas vents covering 20 per cent of the tank surface. For the mixed domestic and industrial sewage the settling period would be 2 hr., the sludge capacity 6.5 cu.yd. per million gallons, with gas vents of 25 per cent of tank surface. For Dorr type sedimentation tanks the rating allowed was 500 gal. per square foot of tank surface. This figure is one-half that claimed by the manufacturers.

Sprinkling filters 6.5 ft. deep were recommended, but additional figures were given for 6, 8 and 10-ft. filters. The load allowed per foot of depth is 3,000 people for the Deep Fork purely domestic sewage, 2,500 people for the domestic sewage alone in the intercepting sewer and 1,500 people with Packingtown sewage added. This makes the plant sizes 0.9, 7.0 and 11.5 acres respectively.

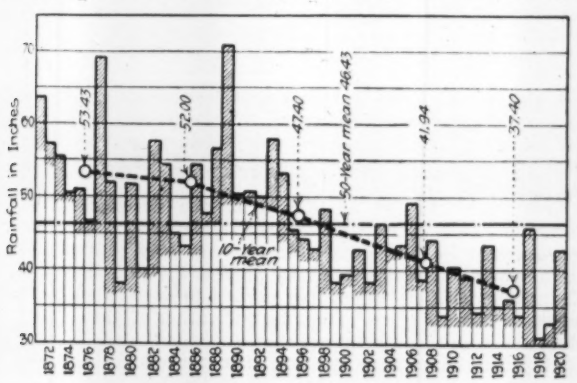
Air requirements in the activated-sludge process are 1.5 cu.ft. per gallon and 5 hr. aëration for the domestic sewage during the dry season, with half the air and 3 hr. aëration for the wet period. For the mixed sewage 3 cu.ft. of air and 8 hr. aëration are allowed, while the Packingtown sewage alone will require 4 cu.ft. of air and 12 hr. aëration.

To dispose of the sludge for the activated-sludge process lagooning was recommended only for the time being. The cost of dewatering was estimated to exceed the market value of the product based on its nitrogen content. The cost of operating dryers and presses is estimated at from $2.10 to $4.50 per unit of ammonia. Coal was taken at $6.80 per ton and power at 1½c. per kilowatt-hour.

## Fifty-Year Rainfall Record, Norfolk, Va.

By Ellis B. Noyes
Portsmouth, Va.

THE accompanying table and diagram show the rainfall at Norfolk, Va., for 50 years, as given by the U. S. Weather Bureau. Taking ten-year means there has been a continuous decrease in the amount of rainfall for the whole period amounting to about one-third inch per year. In the last 25 years there have been only two years in which the rainfall exceeded the mean for the fifty years. I have no theory to account for this steady decrease, and it was only by accident that I discovered the facts while using the reports for an independent investigation.




RAINFALL RECORD AT NORFOLK, 1871-1920

| Year | Inches | Year | Inches | Year | Inches |
|---|---|---|---|---|---|
| 1871 | 63.25 | 1888 | 56.64 | 1905 | 43.29 |
| 1872 | 57.04 | 1889 | 70.72 | 1906 | 49.23 |
| 1873 | 55.43 | 1890 | 50.22 | 1907 | 38.72 |
| 1874 | 50.41 | 1891 | 50.63 | 1908 | 44.25 |
| 1875 | 50.96 | 1892 | 49.24 | 1909 | 33.78 |
| 1876 | 46.54 | 1893 | 57.90 | 1910 | 40.35 |
| 1877 | 69.14 | 1894 | 53.09 | 1911 | 38.95 |
| 1878 | 51.87 | 1895 | 45.41 | 1912 | 34.37 |
| 1879 | 38.08 | 1896 | 44.22 | 1913 | 43.37 |
| 1880 | 51.53 | 1897 | 42.66 | 1914 | 35.05 |
| 1881 | 40.06 | 1898 | 53.14 | 1915 | 36.12 |
| 1882 | 57.67 | 1899 | 38.41 | 1916 | 33.83 |
| 1883 | 54.30 | 1900 | 39.34 | 1917 | 45.63 |
| 1884 | 45.05 | 1901 | 42.61 | 1918 | 30.90 |
| 1885 | 43.25 | 1902 | 38.48 | 1919 | 32.89 |
| 1886 | 54.33 | 1903 | 46.10 | 1920 | 42.91 |
| 1887 | 47.74 | 1904 | 42.60 | | |

A similar diagram of the rainfall at Cape Henry corroborates the showing of that at Norfolk, while one for Richmond indicates that the causes effective at Norfolk and Cape Henry are not acting at Richmond. Cape Henry is on the shore of the Atlantic Ocean. Norfolk is about 20 miles inland from Cape Henry, and about 12 miles south of the lower end of Chesapeake Bay. Richmond is about 90 miles inland from Norfolk. The difference between the first and last ten-year mean is about 25 in. decrease at Cape Henry, 16 in. decrease at Norfolk, and at Richmond 3 in. increase.

## Wyoming and Reclamation Service Co-operative Investigations

### Joint Report of the North Platte Valley Water Resources Passed Upon by Board of Review Now Ready for Final Acceptance

WYOMING and the U. S. Reclamation Service have been making a co-operative investigation of the possibility and feasibility of future reclamation of arid lands in the North Platte valley in Wyoming. The surveys and investigations made jointly have recently been passed upon by a Board of Review and the conclusions of the latter are now before the governor of Wyoming and Secretary of the Interior for signature. The investigation grew out of the fact that Wyoming has felt aggrieved at the policies of the Reclamation Service. The State had granted the right of water to the Pathfinder dam, conditioned, it claimed, on the use of a certain amount of that water in Wyoming on certain lands mentioned in the state permit. Wyoming alleged that this privilege was used to store water, to run water through Wyoming to Nebraska lands, even preventing, through this diversion and through the control of public lands over which new canals must be built, the development of Wyoming in the North Platte Valley. The report is important in that it involves an interstate controversy and a settlement, if the conclusions of the board are accepted, is likely to be made in accordance with the peaceful plan outlined by R. I. Meeker, in *Engineering News-Record*, Jan. 27, p. 157.

The conclusions reached are as follows:

(1) The North Platte River affords a sufficient water supply for the irrigation of the arable lands in the valley that are likely to be developed, provided the available reservoir sites are utilized for storage and all the water available is used to good economic advantage.

(2) Further irrigation development in Colorado and Wyoming need not be restricted.

(3) Further development, and assured water supply for lands now under irrigation, below the North Platte project, depend upon the construction of reservoirs at the Guernsey, Keystone, Lisco or other feasible sites which will conserve an adequate portion of the water now going to waste annually on account of lack of storage and regulation.

(4) The area of land in Wyoming, not now irrigated nor having vested rights that is susceptible of reclamation from the North Platte River and its tributaries, is limited by physical and economic conditions and seems not to exceed about 300,000 acres. Development will undoubtedly proceed slowly, but the lands should be included in any general consideration of the development of the entire North Platte valley.

(5) The same is true of about 70,000 acres of land in North Park, Col. These areas are in addition to 30,000 acres having vested rights.

(6) There are several good power sites on the North Platte River, the development of which, on a large scale, must await the development of suitable markets.

In the discussion of the conclusion as to the sufficiency of the water supply many broad assumptions were made. The question of consumptive use, canal losses, return flow, river losses and the difficulty of closely controlling storage release are more or less indeterminate and the board avowedly leaned toward the side of safety. Some of the assumptions are as follows:

The diversion assumed for the 260,000 acres included in the North Platte Project is 3 acre-feet per acre made up of 1.7-ft. consumptive use and 1.3-ft. loss. This loss corresponds in percentage with the results of measurements on the Interstate Unit during the past seven years which indicate an average loss from canals and laterals of 44 per cent of the quantity diverted. The maximum quantity of water delivered to the land in any year was 2.92 ft. in 1914. With a loss of 44 per cent, this gives a diversion of 5.2 ft. The minimum quantity delivered to the land in any year was 1.38 ft. in 1915, which on a similar loss basis corresponds to a diversion of 2.5 ft. Actually the diversion in that year was 3.3 ft., the losses having been reported as 66 per cent, which is very much greater than has been reported for any other year.

### Quantity Affected by Rainfall

With a diversion duty of 3 ft. and a canal loss of 44 per cent, the quantity available for consumptive use is 1.68 ft. per acre, which is 75 per cent as much as the average past use on the Interstate Unit, 22 per cent more than the minimum past use and 57 per cent as much as the maximum past use. Such quantity appears to be entirely sufficient, especially in view of the fact that the rainfall during the irrigation season averages 12 in. and has a minimum of 6 in.

Moreover, general experience in this and other countries shows a decided tendency for a decrease with time in the amount of water required. This comes as a consequence of filling in the subsoil so that the portion thus consumed is lessened or eliminated; to the increased smoothing of the surface of the fields, so that the large amount of waste in distribution due to a rough and uneven surface is lessened; to the increased skill of irrigators and their greater familiarity with the economical ways of distributing water on their own land and to community knowledge gained from experience that less water is needed for best agricultural purposes than is usually considered necessary.

Under conditions quite similar to the North Platte valley, as the neighboring South Platte valley in Colorado, and notably in the valley of the Poudre, a tributary of the South Platte, where experience and records extend over a number of years, it has been found that the actual amount diverted from the stream has materially decreased. Where formerly 3 to 5 ft. of water were diverted, now the average is only from 1.25 to 1.5 ft. and this is found sufficient.

Further examination of the North Platte valley shows a great amount of seepage or return waters already in evidence.

The conclusion that the water supply of the North Platte River is sufficient for the development of the entire valley is based on the broad theory that the water supply will ultimately be used to the best economic advantage and for the greatest benefit of all the users; that occasional shortage in the water supply amounting to even 25 per cent or 30 per cent of the normal use are likely to prove beneficial rather than harmful in their ultimate effect and should therefore not cause concern; that the use of water must and will adjust itself to the quantity available and that less and less water will be used as time goes on and additional lands are brought under irrigation, not only because less water will be available but because it will be found that less water is needed to raise crops.

The board held that these theories could not be accepted in a case of small area on a small stream but where hundreds of thousands of acres extending along a river for a distance of 800 miles, are to be supplied by such river having an annual run-off of 2,000,000 acre-feet the dangers of disastrous shortage are so remote as to be no cause for concern, provided good engineering judgment has directed the developments.

### Future Policies

The recommendations as to future policies which the United States and Wyoming should follow according to the report are as follows:

(1) That such restrictions as have been placed on irrigation development in Colorado and Wyoming in the past on the supposition that there was an insufficient supply of water be removed. These include the refusal to grant rights of way for ditches and reservoirs on public lands; rejection of desert land entries and failure to act on Carey Act segregations.

(2) That no obstacles be placed in the way of irrigation development in any section of the North Platte valley.

(3) That development by private enterprise be permitted to proceed without artificial restrictions. The natural conditions of the valley provide such limitations that the amount of development is not apt to exceed the water supply.

(4) That no more water be sold from Pathfinder reservoir for diversion below the Whalen dam.

(5) That the proposed dam across the North Platte River near Guernsey, Wyo., be built by the United States at as early a date as possible, as a means of further conserving the water of the North Platte and as a valuable aid in the regulation, distribution and economical use of those waters. This appears to be the most logical next step in the irrigation development of the North Platte valley.

(6) That encouragement be given to development in Nebraska by construction of reservoirs in the lower valley, thus conserving the large run-off below Pathfinder that is now unused.

(7) That the Department of the Interior should expedite action on matters referring to Carey Act projects so that settlers and the state will not be discouraged by delay from carrying out the proposed development.

(8) That both the State and the Federal Governments continue to collect data in regard to stream flow, return flow and other gains and losses of the North Platte River and its tributaries.

(9) That the State and Federal Governments assist the various interests along the river, when solicited, in obtaining accurate information relative to dam and reservoir sites and other information needed for a full knowledge of the situation.

(10) That likewise, in regard to the development of power sites the State and Federal Governments give encouragement by furnishing such facts as may be available and removing obstacles that may prevent their development. The willingness of responsible parties to develop such enterprises is to a great extent an indication of their desirability

(11) The board feels strongly that it would be very unfortunate and decidedly subversive of the best interests of all concerned, if the numerous questions, admittedly vexatious and difficult of solution, could not be disposed of by amicable negotiation and co-operation. Conferences and co-operative effort should therefore be encouraged. If there can be a free exchange of views and discussion of problems by the various parties in interest, misunderstandings and serious differences will be lessened and ultimately removed.

The personnel of the Board of Review included L. G. Carpenter, consulting engineer, chairman, chosen by the other two members; Frank C. Emerson, state engineer of Wyoming, selected by the state, and E. A. Moritz, engineer, selected by the U. S. Reclamation Service. The original joint surveys and investigations were made jointly by Harold Conkling, engineer, U. S. Reclamation Service, and Ralph I. Meeker, an engineer representing the State of Wyoming.

# German Concrete Houses Poured To Full Height in One Operation

*(Berlin Correspondence)*

A NOVEL method of constructing concrete buildings has been developed in Germany. According to the claims of the patent applied for, the basic principle of the method is the molding of complete houses with lean slag concrete, poured in at the highest point of the erected forms. Forms are made in standard parts from wood, and can be used up to twelve times. They can be erected either for the whole building, or in sections of from one to two floors.

The mechanical qualities of the concrete thus obtained have been made the subject of extensive tests by the material-testing institute in Berlin—Dahlem. A section of 35 m. length has been cut out from a wall

FIG. 1. FORMS PLACED FOR POURING WALLS TO FILL TWO-STORY HEIGHT

made by the process, with concrete consisting of 1 part portland cement, 5 parts gravel, and 7 parts coarse boiler slag, the parts being measured by volume. After three months' hardening a compressive strength of 94 kg. per sq.cm. (2,000 lb. per sq.in.) has been developed. An even poorer mixture used in a building near Berlin, consisting of 1 part cement, 6 parts sand, and 14 parts slag, has been tested, and was found to possess sufficient compressive strength for a two-floor building.

The erection of the forms, the molding, and the removal of the forms for one four-family house of two stories has occupied twelve to thirteen days, including six days for the setting. Nineteen workmen were employed on this building for six to seven days. The walls of thickness of 35 cm. dried in a few weeks, on account of the porous structure of the concrete, after which time the walls were coated on the inside and the outside surface.

The concrete of this mixture is a bad conductor of heat, and therefore keeps the rooms warm. It is further claimed that nails can be driven in without using dowels, and that it is soft under the chisel, which facilitates plumbing work.

The costs for a building of the size mentioned are around 40 per cent below those of a brick building of corresponding size.

# Regional Surveys in Relation to Municipal Planning

## Industrial Areas, Agricultural Valleys and Mining Centers Need Survey Before Planning Can Be Undertaken

LARGE cities are overflowing their boundaries and are surrounded by satellite towns and scattered suburbs outside their areas. The regions in which these cities and their satellite communities are situated

FIG. 2. COMPLETED HOUSE—SAME OPERATION AS SHOWN IN FIG. 1

have, in addition to the local problems of each separate municipal unit within the region, a number of important problems which can only be effectively studied and dealt with as regional and not as city or town problems. That is particularly true of the location of industries, the planning of main roads and railway arteries, and the designing of park and sewer systems. Thomas Adams, city planning adviser, Ottawa, made the above statement in a paper presented at the annual meeting of the American Society for Municipal Improvements. The special problems involved he stated are as follows:

In addition to metropolitan districts surrounding large industrial centers, there are valleys, like the Boise Valley in Idaho, where a number of towns are scattered throughout a fertile farming region which need to be planned as a whole. The development of the separate communities in the Boise Valley depends largely on the development of the system of transportation by rail and road, and the utilization of water for power and irrigation for the whole valley.

In territory where there are mining operations, the need of the regional plan is perhaps most evident because the specially scattered nature of such operations results in the

growth of a series of small towns or villages around the pit-heads, with probably one or two main commercial or business centers in the neighborhood.

In all such cases the following problems need regional consideration and treatment:

1. Control of overflow of population from the main center following industrial expansion along railway and rivers, or taking the form of new residential suburbs.

2. Design and development of main arterial system of roads radiating from central districts to adjacent towns and rural areas or forming connecting highways between the radiating highways and coming under the jurisdiction of several municipal councils.

3. Planning extension of railway and other transportation facilities, with their terminals and stations, in relation to the growth of industries and population and the topographical conditions.

4. Planning and acquisition of parks and parkways so as to form a comprehensive system for the complete district.

5. Making the zoning plan to control height, use and lot occupancy effective over an area sufficiently wide to prevent bad beginnings of development in the unbuilt suburbs and to be sure that the progressive action of one municipal council will not be made ineffective by the lack of control outside its boundaries.

6. Planning of comprehensive sewage treatment, water supply and power developments where topographical or industrial conditions make united action of adjacent municipal councils desirable or even necessary for economy and efficiency.

No proper plan can be prepared as a guide for future development until a map or series of maps are prepared after a survey showing the existing development and, in the case of uneven country, the levels of the land.

The first object must be the promotion of industrial efficiency, since the city or district depends on its industries. Another main object must be the development of healthy housing conditions, since industrial success which is achieved at the expense of the health and strength of character of the people can only be temporary so far as the industries themselves are concerned, and can only lead to decay so far as the nation is concerned. Housing conditions mean not only homes but their environment, the protection of their surroundings, the development of recreation facilities near the homes, the provision of water supply, sewerage and facilities for transit.

The first need is an accurate topographical map showing the whole natural and structural characteristics of the area as well as the levels of the land. The minimum scale should be 200 ft. to 1 in. and the contour intervals 5 ft. Most cities in America are bady equipped in regard to maps. The cost of preparing them is considerable and may be estimated at from $1.50 to $2 per acre. Where practical this topographical map should be supplemented by an aerial photographic map, the probable cost of which would be $200 to $300 per square mile. Oblique photographs of important areas should also be taken from the air.

The topographical maps being prepared, accurate information should be indicated on a series of prints of these maps. For regional areas this information should comprise the following particulars: (1) Industrial development, including the arrangement and classification of all lands and the location and distribution of manufacturing plants. (2) Economic use and regulation of the subdivision of land and the character and density of structures in rural and urban areas. (3) Housing, sanitation, convenience and amenity. (4) Railways and transportation. (5) Highways. (6) Waterways. (7) Sources and distribution of power. (8) Water supplies and sewerage. (9) Civic art, including parks and boulevards.

## Public Health Department for Australia

A Department of Public Health for Australia has been created. According to *Public Health Reports*, the new department will investigate all manner of diseases, have control of laboratories, and of the Australian Institute of Tropical Medicine.

# Proposes New Rail Specification as Compromise Measure

### Robert W. Hunt Aims at Better Rails—Top or "A" Rails May Be Rolled Into Tie Plates—No High Limit for Carbon

IN AN endeavor to effect needed improvements in rail manufacture and to offset the hostility of rail makers to the specifications drafted by the rail committee of the American Railway Engineering Association (see *Engineering News-Record*, March 24, 1921, p. 515), revised specifications have been prepared by Robert W. Hunt, consulting engineer, Chicago, and submitted by him to a long list of engineers, railway officers, rail manufacturers and others interested in the rail problem.

Safety or freedom from fracture, rather than freedom from wear, is the feature chiefly desired at the present time according to Mr. Hunt, who considers that there is little if any dissatisfaction with the wear of open-hearth rails. On the other hand, the railways feel that they are not obtaining rails which will give good life under ordinary conditions and will also be free from failures. To quote Mr. Hunt's statement: "In addition to the annoyance and expense caused by defective rails which have to be removed from the track after comparatively little service, the anxiety and menace to life caused by actual broken rails is very great. Head failures in rails rolled from metal forming the tops of the ingots are apparently on the increase, and internal fissures constitute a defect most dangerous and deserving of the fullest study."

### Tie Plates Rolled from Top Metal

*Control of "A" Rails*—That each ingot is a unit and should be tested and treated as such has been contended for several years by Mr. Hunt, who for this reason has strongly recommended the nick-and-break test for every ingot, as proposed by him in January, 1912. He states that for the past six years this test has been employed for practically all rails made in Canada, but that it has not been given a thorough trial in this country because American rail manufacturers would not permit it. As an alternative, therefore, his new specification provides for the elimination of rails made from the top of the ingot (known as A rails), if the manufacturer so elects, by rolling these rails into tie plates which will be accepted by the purchaser. The clause covering this plan is as follows:

> In case the manufacturer elects after due notice, the purchaser agrees to accept hot sheared, punched and annealed tie-plates rolled from the steel that, in the ordinary course of the manufacturer's practice, would be rolled into "A" or top rails from the ingots cast under this specification. It is understood that such tie-plates shall be in accordance with purchaser's drawings and specifications.

*Chemical Composition*—Elimination of a high point or maximum for both carbon and manganese is another feature of the new specifications, which provide only for a minimum of 0.60 per cent in each case. It is held that excess of these elements is highly improbable, as rail makers seek to avoid it. Further, it is considered that in controlling the chemical composition it will be much easier to keep the content above a specified minimum than to keep it between maximum and minimum limits. There is also a minimum limit of 0.10 per cent for silicon and a maximum limit of 0.04 for phosphorous. Rails rolled from heats containing

more than 0.75 per cent carbon, but not more than 0.9 per cent manganese and 0.03 per cent phosphorous, are to have the flanges near the ends painted yellow. These rails also would be shipped separately.

*Destruction and Drop Tests*—A destruction test, supplementary to the drop test, is included in the new specifications, as given below, but this is waived when a top discard of not less than 20 per cent is made on all ingots from which rails are offered for test and inspection. New regulations are included also for the drop tests as follows:

Drop Tests (10).—If two of the test pieces do not break at the first blow, all of the rails of the heat shall be accepted, subject to the requirements of Section 11. If two of the test pieces break at the first blow, all of the top rails of that heat shall be rejected. Second tests shall then be made from three test pieces selected by the inspector from the bottom end of the top rails of the same heat and ingots. If two of these test pieces do not break at the first blow, all of the remainder of the rails of the heat shall be accepted, subject to the requirements of Section 11. If two of these test pieces break at the first blow, all of the second rails of the heat shall be rejected.

Third tests shall then be made from three test pieces selected by the inspector from the bottom end of the second rails of the same heat and ingots. If two of these test pieces do not break at the first blow, all of the remainder of the rails of the heat shall be accepted. If two of these test pieces break at the first blow, all of the remainder of the rails of that heat shall be rejected. If two of these test pieces break at the first blow, all of the remainder of the rails of that heat shall be rejected.

PROGRESSIVE TESTING

Destruction Tests (11).—A test piece representing the top end of the top rail from each ingot of each heat rolled, which has passed the drop test requirements of Section 10, shall be nicked and broken to determine whether the interior metal is sound. If an interior defect shows on the fracture, the top rail of the ingot represented shall be rejected and a second test piece cut from its bottom end shall be nicked and broken to determine the character of the metal of the second rail. If an interior defect shows on the fracture, the second rail shall be rejected and a third piece cut from its bottom end for retesting. Thus the rails of each ingot shall be tested progressively from the top downward until the fracture shows sound metal, following which the rails of the ingot represented shall be accepted. An interior defect is interpreted to mean seams, laminations, cavities or interposed foreign matter, or a distinctly bright or fine-grained structure in the center of the section evidencing segregation, made visible by the destruction tests, the saws or the drills.

*Milling and Straightening*—Milling the rail ends is a new requirement proposed by Mr. Hunt, who also provides for reducing the amount of cold straightening. From his experience covering a number of years he believes that the cold straightening of rails can be minimized and in some cases eliminated without detriment to the track conditions, and with a saving to the manufacturers which would more than cover the cost of milling the ends square and free from burrs. After the usual requirement that "hot straightening shall be done carefully, so that gagging under the cold presses will be reduced to a minimum," there is a new clause:

All rails shall be smooth on the heads, without rough crescent-shaped marks, and the bases shall be free from guide marks and scratches. They shall be milled square on both ends, but a variation of $\frac{1}{32}$ in. in a vertical direction to make head-long rails will be permitted. All rails shall be free from twists, waves, kinks or short bends, but rails containing a uniform sweep, the middle ordinate of which does not exceed 1 in. in 33 ft., will be accepted without cold straightening.

As to fissures, Mr. Hunt believes that better attention to soaking pit practice and restriction of the cold straightening will afford relief ultimately from the development of internal fissures. In concluding his statement which accompanies the new specification he points out that the specification is not offered as the best that can be prepared, but with the thought that it "may help to compose the difference existing between the rail makers and rail users, and to afford thereby a groundwork for a common standard which will insure good safe rails at the base price."

## Concrete Blocks Mark Cross-Walks

BY JAMES S. SHEEHY
Portland, Ore.

CONCRETE BLOCKS for marking cross-walks at street intersections have proved so successful in Portland that the city may use them in future to mark safety zones throughout the downtown business district. The blocks are 2 ft. long and 6 x 6 in. in cross-section. They are precast and made of portland cement, sand and gravel. The lower part or main body of the block consists of a 1:2:4 mixture. The top half inch is made of

PORTLAND CROSSINGS MARKED WITH CONCRETE BLOCKS

Medusa or white cement in proportions of one-half cement and one-half sand.

The blocks were made for the city of Portland, by the Concrete Pipe Co. and to get smooth surface they were cast face downward. The bottom of the form is a piece of celluloid slightly curved so that when the block is inverted the top will have the proper crown.

The pavement has to be cut to a depth about ½ in. greater than the block itself when the blocks are placed. Underneath and along the sides, with the exception of the top inch, is placed a cushion of 1:2 dry cement-sand mortar. The blocks are then set and the upper inch of the space around each block is filled with Sarco putty, an asphaltic compound.

During the past eight years the city of Portland has painted each summer traffic strips in the downtown section amounting to 15,000 lin. ft. The accumulated cost of painting and repainting has amounted to about $2 a lineal foot. The paint is readily worn away by traffic and washed off by city street cleaning flushers. Engineers of the city believe that the concrete block will outlast the pavement. Each block costs $1 to manufacture. The total cost of the block, cutting, pavement, setting, truck work and material is $4.17 per block. Figuring 56 blocks at each intersection and 288 lin. ft. of line marked the cost is 80c. per linear foot of line.

# LETTERS TO THE EDITOR

***If you have ideas that would interest engineers and contractors we shall be glad to give them space here. We urge, however, that you be brief so that a wide range of subjects may be covered in the available space.—The Editor.***

## The German Settlement

Sir—The recent editorial in *Engineering News-Record* (May 19, page 837, entitled "The German Settlement"), seems to me to lack in a couple of sentences its own term, "fair mindedness." It appears to show a lack of appreciation that it was France, not Britain nor America that suffered the wilful devastation of the Hun and that, therefore, there is no good reason why fair-minded people of France as well as those of America and Great Britain should be inclined to leniency toward the German until he has paid his debts, even if the making good in part of the mischief he has done, should be "a detriment to Germany's necessary financial and commercial relations with the rest of the world." Should it take a generation of German work to pay the reduced terms now asked by the Allies, can fair-minded people say that justice requires less, or that the principal victims of German aggression should not have at least as much after-war sympathy as the nation that deliberately planned a war of conquest, whose entire cost was to be assessed on its victims, ourselves included?

There seems everywhere plenty of the spirit of fair-mindedness for our enemies. Let us still preserve it for our friends. HENRY WELLES DURHAM.

Lima, Peru, June 27, 1921.

## Mutuality of Interest Between Owner and Contractor

Sir—The writer has read, with interest, the article appearing on page 1109 of the June 30 issue, entitled, "Ethical and Practical Considerations Regarding the Engineering Corporation," and believes that the thought expressed near the top of the second column of that page with reference to the oppositeness of interest of owner and contractor is responsible for much, if not all, of the lack of harmony and co-operation between engineers and architects and contractors.

If the engineer and architect would take the stand that the interests of the owner and contractor were identical and not opposite, and if they would write their specifications and contracts, and after they were written interpret them in a way which would give the contractor a "square deal," the architect and engineer would have enough to do in attending to and supervising their part of the work without encroaching on the field of the contractor.

For example. It is usual to order the structural steel work of a building in advance so as to insure that it will be on hand when wanted. Very often the foundations are not ready, and as the shop has no facilities for storing, it is shipped and the contractor must arrange for handling and storing the entire tonnage with the increased cost incidental thereto. The engineer or architect insists always that the contractor must absorb this cost, although if the contract were being handled by the engineer on the basis of the "larger stipulated fee" mentioned the owner would not only pay this extra cost but the "larger stipulated fee" on this cost as well.

Architects and engineers many times let the contract before the plans and specifications have been completed, and are continually making changes and additions which materially increase the cost. If the work is handled by the engineer or architect directly, the owner pays for these additional costs, plus the "larger stipulated fee," but if the contractor after indulging in the keenest of competitions for the contract, dares to open his mouth to ask for the additional compensation, to which in all fairness he should be entitled, he is told that "a contract is a contract and that was a contractor's risk" and all sorts of similar tommyrot.

When architects and engineers get out of their heads the narrow wooden idea that the owners' and the contractors' interests are opposite, and act upon the theory that they are identical, the owner will get cheaper and better construction, the architect and engineer will receive a fair and just fee (not the larger stipulated fee), and the contractor will earn the living to which a lifetime spent in a highly specialized business entitles him.

Is it not barely possible that the contractor, having been purchasing supplies and handling labor all his life, may be able to so conduct the work that he can make a profit at the *cost* of the work done under the so-called administration plan and save the owner "the larger stipulated fee?"

There are many engineers and architects who believe and act on the "live and let live" Golden-Rule principle, and these men never have the trouble spoken of in the article, but receive the co-operation and support which comes from a correct understanding of what constitutes a *mutuality*, not an opposition of interest. E. HAUPT.

Chicago, July 21, 1921.

## What Is a Profession?

Sir—I have read with interest your articles in *Engineering News-Record* of July 7, entitled "What Is a Profession?" and "the Builders' Code."

"Profession," according to the dictionary, is an occupation that involves a liberal education, and mental rather than manual labor.

A professional man is one whose stock in trade is knowledge and who has nothing to sell but that knowledge. The lawyer sells knowledge of law; the clergyman sells knowledge of religion; the doctor sells knowledge of medicine; the engineer sells knowledge of engineering science. None of these has any stock other than that which he carries around in his head.

When the doctor opens a drug store and devotes his time to selling drugs, instead of his knowledge of them, he ceases to be a professional man and becomes a merchant. When the engineer goes into the contracting game and devotes his time to selling materials and to the actual work of construction, he ceases to be a professional man and becomes a contractor.

If the contractor is a professional man, then so is any other manufacturer a professional man. As the automobile maker makes cars of materials and labor, just so does the contractor make bridges and buildings of materials and labor. They are manufacturers but are in no sense of the word professional men. The designers of the cars, the bridges and the buildings are professional men. SUBSCRIBER.

Memphis, Tenn., July 13, 1921.

## Designing Data on Japanese Wireless Tower

Sir—Your article "Concrete Wireless Tower 672 Ft. High in Japan," May 19, 1921, p. 847, is not correct in some points. The design was almost entirely in the hands of Professor Ksama, under my own general direction. Assistant Professor Nagayama contributed in the design of the top frame work and some minor details, while the Oriental Compressol Co. (a Japanese firm) assisted us in making some drawings. The specifications for the execution of work were prepared by me, but they were modified more or less by the Department of Communications. The execution of work was undertaken by the above-mentioned firm, under the superintendence of the Department of Communications. Mr. Nagayama helped this superintendence, while Mr. Ksama and I took no part.

The principal data for the design of the structure are: (1) The force due to the antennæ was taken at 25,000 lb., acting horizontally at the top of the tower in the same direction as the wind. (2) The wind pressure on a plane area was taken at 60 lb. per square foot at the ground level, and 126 lb. per square foot at the top, changing uniformly between these two extremes, while the coefficient of reduction for the projected area of the shaft was taken at two-thirds. (3) Weight of reinforced concrete 150 lb. per cubic foot; weight of earth 100 lb. per cubic foot. (4) Allowable compressive strength of concrete, 650 lb. per square inch; shear-

ing strength of concrete, 50 lb. per square inch, and tensile strength of steel, 22,000 lb. per square inch. The maximum calculated pressure on soil was 9,450 lb. per square foot. The center of pressure lies outside of the core of the base by 0.14 ft. (5) Maximum seismic horizontal acceleration 948 mm. per second.

No change of temperature was ever considered. I designed no part of the structure according to the patented system of the Weber Chimney Co. I don't know what that system of designing is. K. SHIBATA,

Professor, Tokyo Imperial University, Japan.

Tokyo, Japan, June 30.

## Freight Rates as a Deterrent to Construction

Sir—Referring to the item from the Common Brick Manufacturers in *Engineering News-Record* of June 9, p. 1013, I wish to comment on the concluding paragraph therein which starts off with the following:

"Freight rates continue to be the greatest handicap in the way of construction, . . ."

This is manifestly an erroneous statement. For instance, common brick in the city of New York come down by barge and the railroad freight rates have no effect whatever on this traffic.

Lumber from the Pacific Coast is moving into New York by water and the rail freight rates are not a consideration.

Cement is manufactured so near New York that the freight rate is only an incidental matter.

Furthermore, the carriers held an extended session with the building material men and subsequently issued a statement. I was present at the conference and I can say that nothing was presented by the building material representatives which justifies any reduction in the railroad freight rates.

Would it not be advisable for a publication of the high standing of the *Engineering News-Record* to safeguard carefully the news columns against statements which may have a very disturbing effect upon the general business of the country. T. C. POWELL,

New York, July 7. Vice-President Erie R.R. Co.

[A copy of Mr. Powell's letter was sent to the Common Brick Manufacturers Association, publisher of the digest referred to, and the secretary has replied as follows.—EDITOR.]

Sir—The common brick industry was not a party to what is called "the big freight rate case," now before the I. C. C. For this reason we were not notified of the hearing with the railway executives at Washington mentioned by Mr. Powell. I understand that the first hearing dealt largely with road-building materials and that an effort was made to hold a subsequent meeting at which all the construction elements might be represented. To prepare for this proposed meeting I sent a questionnaire to twenty-five typical plants in scattered centers throughout the Middle West, East and Southeast. The hearing was too near at hand to permit of receiving replies from the Far West. Upon information received in these questionnaires and upon our correspondence with members, contractors and architects over a period of many months, the statements in our digest are based. The report referred to by Mr. Powell is the version of the carriers only and not an official report of this hearing.

The statements in Mr. Powell's letter refer mainly to New York City, while our digest covers the whole country. New York is not the largest brick producing center, plays only a small part in the national situation, and does not enter into this controversy to any extent. It is true that most of this brick is carried on river barges.

Here are some of the questions asked and answers received:

1. "What proportion of your delivered-on-the-job price of brick today goes to pay for freight on fuel and freight on bricks?" Answers showed percentages from 15 per cent to 50 per cent; average 32 per cent.

2. "In percentage, what has been the greatest increase since 1915 in freight rate on brick from your plant to any principal market?" Answers from 60 per cent to 504 per cent! average 193 per cent.

3. "Would lower freight rates on brick and other building materials (say a reduction of 25 per cent), stimulate building in your market?" Two answered no; one of these stated he delivers entirely by truck; the other was so situated that his increase in rates was only 60 per cent. All others emphatically state that reduction of freight rates would stimulate building. Several reported their plants closed because the price of brick plus freight was prohibitive in their principal markets. Many expressed the opinion that 25 per cent was not a sufficient reduction.

General Order 28, imposed during the war, placed an arbitrary freight increase of 2c. per 100 lb. on brick. It was explained that this was frankly intended to discourage brick manufacture and shipment to favor direct war needs. This increase has never been taken off. When the I. C. C. granted the increase of rates from 25 per cent to 40 per cent, this was on top of General Order 28. Here are some of the specific results of these increases:

North Haven, Conn., is one of the largest brick producing centers in New England. The rate to Boston in 1915 was 91½c. a ton; and to New York 70½c. a ton. The rates today are: to Boston, $2.24 a ton; to New York, $1.96 a ton. The principal manufacturers in that section state that these two markets are entirely eliminated by these rates. It now costs $5.60 to ship a thousand brick from North Haven to Boston and $4.90 to New York. Add delivery from railroad to job and elimination of these markets is explained.

All Norfolk, Va., brick plants are located a few miles out of the city. In 1915 the rate per thousand brick, plant to city, was 50c. Today it is $1.87½ plus 175 per cent increase in switching charges.

Cincinnati manufacturers report that an average increase of 247 per cent on rates have entirely shut them out of Middletown, Hamilton, Miamisburg, West Carrolton, Tippecanoe, Piqua, Troy, Dayton and Springfield.

In Columbus, Ohio, the rate from plant to city in 1915 was 37c. a ton; today it is $1.12—a tax of $2.80 a thousand brick from the nearest plant to a city railroad siding.

Placing a thousand brick on a siding in Trenton from Fieldsboro, seven miles distant, now costs $4.44, as against $1.26 in 1915. Fieldsboro delivers to Trenton now exclusively by truck.

In the Baltimore territory an increase from 65 cents in 1915 to $1.40 per thousand brick has closed all plants except those that make truck deliveries. Buffalo is supplied from plants 11 to 14 miles away. It costs $5 a thousand brick to ship from plant to city. Many manufacturers now make deliveries by truck.

I can state without fear of contradiction that the yard price of common brick today throughout the United States is based upon the actual cost of manufacture, plus a profit yielding only a small return upon investment down to no profit at all. Due to competition, brick is being sold in many parts of the country at less than cost to manufacturers. An average price of common brick at the yard, taking all the principal producing centers into consideration, is $15 today.

The great majority of brick plants dependent upon rail transportation are closed or operating at a fraction of capacity; while plants able to reach their principal market by truck are operating at from 50 to 100 per cent capacity.

Brick men cannot understand why a penalty imposed during the war frankly for the purpose of stopping operation should be allowed to remain when the country needs construction as badly as it needed munitions in 1917 and 1918. RALPH P. STODDARD,

Cleveland, July 15. Secretary-Manager, Common Brick Manufacturers Association of America.

## Partly Shut Valves Reduce London Water Use

**By partly closing all main valves on the water distribution system of London, England, between 6 p.m. and 6 a.m. the total water consumption was recently reduced by 44 m.g.d. (U. S.) over the rate a year ago or to a total of 307,000,000 U. S. gallons a day.**

# HINTS FOR THE CONTRACTOR

## Homemade Device Gives Hot Water for Washing in Camp

AN EFFECTIVE means of providing hot water for construction camps where there is a piped water system but where a tank or boiler is not available, is shown in the accompanying illustration. The only material required is a few lengths of pipe, preferably about 1 in. in diameter, and some scrapped sheet metal. The pipe is roughly coiled so as to form a hollow cylinder about 30-in. in diameter and is connected to the water supply line near the tap where hot water is desired.

PIPE COIL FOR HEATING WATER IN OPEN FIRE

Around the coil the metal sheets are set up to form a wind shield and the equipment is complete. A fire built inside the pipe coil heats the water quickly and by keeping the fire up and drawing the water slowly a continuous supply of hot water can be maintained.

The arrangement shown in the accompanying illustration was used by the Southern Pacific Co. to supply water for washing in a temporary camp where the men lived in cars on a siding on the Tehachapi Pass.

## Locomotive Turbines for Flood Lighting Night Construction

APPLICATION of locomotive headlight turbines for generating current to operate flood and headlights on steam shovels and construction locomotives engaged in night work has recently been tried with success by the Mandle Clay Mining Co., Whitlock, Tenn. The equipment of the company for mining operations consists of two steam shovels and three shifting locomotives, on all of which are mounted floodlight projectors and 500-watt headlight turbines of the same type as used for locomotive headlights, having a pressure range suitable for construction equipment.

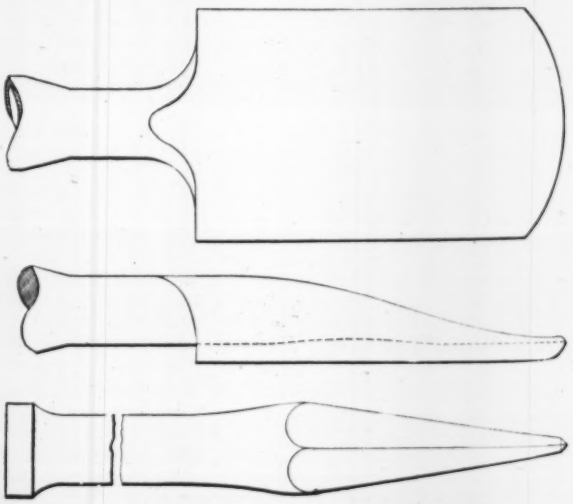
LOCOMOTIVE TURBO-GENERATORS MOUNTED ON CONSTRUCTION EQUIPMENT FOR NIGHT FLOOD LIGHTING

The larger of the two shovels has the floodlights mounted to illuminate directly the point at which the bucket is operating, the headlight on the shifting engine serving to aid in unloading into the car. The floodlights on the smaller shovel which is of the revolving type are so placed that they not only illuminate the bucket's field of operation, but, when the shovel is swinging around for unloading, they light up the car.

The turbines on both shovels and locomotives are of the standard type built by the General Electric Co. for locomotive headlights. They are equipped with low pressure valves and nozzles carrying rated voltage and capacity between 70 and 170 lb. boiler pressure with a water rate of approximately 110 lb. per hour.

## Tools for Tunneling with Pneumatic Hammers

A BULL POINT and "shovel" blade successfully used with a rivet hammer in tunneling indurated clay, with pebbles, are illustrated by the sketches. These tools were 18 to 20 in. long and were used in a regular Thor long-stroke riveting hammer with the regulation one-piece safety retainer. Men with hand picks and shovels were making slow progress; the speed was quadrupled by the pneumatic tools. The tunnel, 1,500 ft. long, with two 10-ft. shafts, 76 ft. deep, was completed in 10 days with three 8-hour shifts of eight men operating at each end. The Nash Construction Co., Chicago, Ill., was the contractor.



BULL POINT AND SHOVEL BLADE FOR PNEUMATIC HAMMER

# NEWS OF THE WEEK

New York, August 4, 1921

## Duties of State Engineer of New York Increased

**Transfers from Health and Conservation Departments—To Do Engineering Work on Water Power**

A start has been made in the direction of carrying out the policy outlined by the Governor of New York in his first annual message to the legislature of combining, under the state engineer, all the engineering work of the state. On July 1 laws passed by the 1921 legislature went into effect transferring engineering work heretofore performed by the State Department of Health and the State Conservation Commission to the Department of State Engineer and Surveyor, thus bringing this work under the jurisdiction of Frank M. Williams, state engineer. Other legislation created the New York Water Power Commission, which is composed of the conservation commissioner, the attorney general, the state engineer, the president pro tempore of the Senate and the speaker of the Assembly. The engineering work for this new water power commission is now being performed by the state engineer.

PUBLIC HEALTH AMENDMENTS

The amendments of the public health law abolish the division of sanitary engineering under the State Health Commission and create the division of sanitation. Prior to this amendment, plans for sewerage and sewage disposal submitted to the State Department of Health went to the division of sanitary engineering for examination and report. Previously this division also made investigations and reports on existing water supply and sewage works, public reservoirs, stream pollution, violation of rules and regulations for the protection of watersheds, milk pasteurization plants and suppression of mosquitoes. Under the new legislation the bureau of sanitary engineering of the state engineer's office will perform, according to Mr. Williams, the strictly engineering work, leaving other matters to the health department.

By amendments to the Conservation Law all engineering work heretofore performed by the Conservation Department will be handled by the state engineer. This affects matters dealing with plans for public water supplies and for water storage together with the inspection and approval of plans for the construction of docks and dams. A three-headed commission, composed of the conservation commissioner, attorney general and state engineer, is formed and has jurisdiction over land drainage for agricultural purposes,

*(Continued on p. 208)*

## Introduce Bill for Harding Railroad Financing Plan

A bill has been introduced in Congress by Representative Winslow, of Massachusetts, chairman of the interstate commerce committee of the House, to carry out President Harding's recommendations for immediate legislation to afford financial relief to the railroads. It is the purpose of the bill to release to the railroads amounts due them by the Government from the period of federal control, now being held up to offset the indebtedness of the carriers to the Government for capital expenditures under the Railroad Administration. The bill authorizes the funding of the carriers' debt to the Government, estimated at over half a billion dollars, through the War Finance Corporation.

## New York Port Authority Meets with Rail Executives

A meeting between the presidents of railroads entering the Port of New York and the Port of New York Authority to consider plans for improving the freight situation of the port was held in New York City July 26. It was announced that the conference took up the subject of belt lines to connect terminals, and it was stated that they would be of advantage in releasing water-front property and bringing rail connections directly to ships.

The Port Authority is continuously holding meetings with representatives of civic and business organizations of cities and communities within the Port District to assist in formulating a plan for recommendation to the legislatures of the two states before Jan. 1, 1922.

## Movement Begun for Road Bond Issue in South Carolina

A good roads association has just been organized in South Carolina and some of the officers have expressed an intention of proposing a $50,000,000 bond issue to the next session of the General Assembly. In order to issue state bonds in South Carolina, according to information received from Charles H. Moorefield, state highway engineer, the issue must first be approved by the General Assembly, next voted by the people, and, third, confirmed at the subsequent meeting of the General Assembly, all of which would involve about two years' time.

There is a strong probability that some scheme for financing road improvement by means of a bond issue will be pressed before the next General Assembly, but no definite policy has been announced by those who are agitating the matter.

## Pontoon Bridge Across Hudson Proposed

**Senate Bill Would Authorize Structure Supported by 50 Shipping Board Wood Vessels**

Preliminary steps in a project for facilitating interstate vehicular and pedestrian traffic between New York and New Jersey were taken last week when Senator Frelinghuysen, of New Jersey, introduced in the Senate a bill authorizing the construction of a pontoon bridge across the Hudson River between Yonkers, N. Y. and Alpine, N. J. While detailed engineering plans for such a structure have not, as yet, been made, the general scheme is based on the use of about 50 of the wooden vessels which the U. S. Shipping Board is trying to dispose of. The plan is sponsored by George A. Post, president of the Hudson River Bridge Corp., who has been advised by Gustav Lindenthal, consulting engineer, that there are no engineering difficulties serious enough to make the project impracticable. The structure planned is a temporary one and would probably not be in service more than ten years. Its advocates feel that, once built, it would serve as an object lesson in relieving interstate traffic congestion and would be a convincing argument in winning public support for the proposed permanent steel bridge across the Hudson, described in *Engineering News-Record* of May 26, p. 901.

CONSTRUCTION BY PRIVATE CAPITAL

Senator Frelinghuysen's bill would create a bridge building corporation the personnel of which would include, in addition to Mr. Post, Thomas A. Gillespie, of the contracting firm of that name, R. A. C. Smith, former New York dock commissioner, and a number of others. No appropriation by Congress is asked, as the bridge would be built by private capital and paid for by toll receipts. The bill further specifies that work must be begun within one year after its passage and completed within two years.

Pending the preparation of more detailed plans the War Department, which will be charged with approval of the site, type of structure, and toll charges, is understood to have put no obstacle in the way of the project, although Col. Edward H. Burr, Corps of Engineers, U. S. A., in charge of the New York District Engineer Office, has not as yet been called upon officially to report upon the plan for the proposed pontoon bridge.

Major W. A. Welch, general manager and chief engineer of the Palisades Interstate Park Commission, is credited

with the conception of the Hudson River pontoon bridge. Some time ago the U. S. Shipping Board sought anchorage along the Palisades water front for a fleet of its wooden vessels, agreeing to pay a rental charge for such mooring privileges. When this proposal reached Major Welch he suggested that these ships be put to some useful purpose and recommended that the feasibility of their employment as supports for a pontoon bridge across the Hudson be looked into. This proposal was taken to the Hudson River Bridge Corp., and after its chief engineer, Mr. Lindenthal, had endorsed the feasibility of the general scheme, authorization for the structure was sought by Mr. Post through the medium of such a bill as Senator Frelinghuysen has introduced.

### To Cost $2,000,000

According to present estimates the pontoon bridge can be built for $2,000,000 or less and will require 50 of the Shipping Board's vessels. These are wooden boats of the Ferris type, each with a length of 268 ft. and a beam of 45 ft. In order to provide clearance for river traffic it will probably be necessary to construct some sort of tower support on each vessel so that the main bridge structure may be carried at a height of about 40 ft. above the surface of the water. It is planned to have a lift span for larger vessels, such as the Hudson River Day Line boats, near the center of the bridge.

At the tentative point of crossing the Hudson River is about 5,000 ft. wide, with a maximum depth of 40 ft. The normal tidal current is from 3 to 4 miles an hour and the rise and fall of tide about 4 ft. It has been suggested that screw piles be employed as a means of anchoring the vessels for the pontoon structure. Originally the bridge would be constructed to carry two lanes of traffic, one in each direction, additional width to be provided if the volume of traffic developed warrants such expansion. In the event of approval by the War Department and the passage by Congress of the bills now before it, it is understood that no additional legislation by the States of New York and New Jersey would be necessary to enable construction work to begin.

## Commend Highway Council

A resolution by the directors of the Mississippi Valley Association commends the Federal Highway Council in undertaking a survey of every agency of transportation for the purpose of determining in the public interest the respective sphere in which the different form of transportation are most economic, efficient and practical. The resolution states that the Mississippi Valley Association agrees with the Secretary of Agriculture in his statement that "unquestionably it is desirable to bring about a greater correlation of the different means of transportation so that each may be more useful in its field."

## Tacoma to Protect Pipe Line from Flood Damage

The city of Tacoma, Wash., and Pierce County will immediately take steps to construct protection works at McMillin, where the Puyallup River threatens to destroy the city's gravity water pipe line. The river has cut its way to within 100 ft. of the pipe, and another flood, it is feared, would probably mean the complete destruction of the city of McMillin. W. A. Kunigk, of the Tacoma water department, and County Engineer E. A. White have made investigations and favor the condemnation of land for a new river channel. An estimate of $30,000 has been set for the entire protective work, which will include rebuilding the drift barrier piers which sank last year due to undercutting by floods, and the placing of brush mattresses to protect the banks and check currents. The cost will be divided equally between the city and county.

## Montclair Water Co. Declines Offer

The Montclair (N. J.) Water Co. has declined the town's offer of $700,000 for its distribution system, noted on p. 167 of our issue of July 28. The valuation report of Clyde Potts and related matters have been referred to John Milton, corporation attorney of Jersey City, and special counsel for Montclair, to institute condemnation proceedings.

## N. Y. State Engineer Reorganization

(*Continued from p.* 207)

stream flow, river regulation and municipal water supply.

The New York Water Power Commission has jurisdiction over the issuance of licenses for the development of water power projects in which the State has proprietary right or interest. The act creating this commission is similar to the federal water power act. This commission, through the state engineer, investigates the water power possibilities of the State.

As regards personnel, the amendments have resulted in the following transfers of heads of bureaus to the State Engineer's Office: Theodore Horton, formerly chief engineer of the engineering division of the State Department of Health becomes chief sanitary engineer of the Bureau of sanitary engineering. A. H. Perkins, formerly division engineer of the division of waters in the Conservation Commission is division engineer in charge of the bureau of drainage and stream regulation. E. H. Sargent becomes senior assistant engineer in charge of the bureau of water supply. A. R. McKim, inspector of docks and dams under the Conservation Commission, is in charge of the bureau having supervision over docks and dams. F. P. Williams, formerly special deputy state engineer, in charge of the construction of the Barge Canal and Barge Canal terminals, is secretary of the New York Water Power Commission.

## Action Against Harbor and Beach Pollution by Oil Wastes

Oil, tar and asphalt wastes from tankers and other water craft and from industrial plants on shore have led to the formation of the Interstate Committee of One Hundred on Pollution of Coast Water and Beaches (New York and New Jersey), which has petitioned Congress for relief. Exisiting federal statutes, it is said, apply to New York Harbor only. It is also said that the nuisance has increased greatly in the last three years with the growth of the oil trade and in the use of oil for fuel by vessels. That this kind of nuisance is not confined to the New York and New Jersey shores is shown by the fact that the Rhode Island legislature of 1920 created a board of purification to control water pollution other than that affecting the public health. The Rhode Island board has specific jurisdiction over the discharge from water craft of petroleum and allied wastes (see *Engineering News-Record*, Nov. 4, 1919, p. 914).

## Philadelphia Sewage-Works Contract to Be Completed

The resumption of construction work on the contract for the Northeast sewage-works for the city of Philadelphia is to be resumed under the original plans and specifications as soon as an agreement between the city and the National Surety Co. of New York, already authorized by city ordinance, has been executed. The contract was abandoned by the Philadelphia Subway Construction Co. on June 28, 1920. The original contract, dated Aug. 7, 1917, was for $1,025,000. The new contract with the bonding company authorizes the payment of $275,000 additional. Frank H. Caven is director, and Joseph C. Wagner assistant director of Public Works.

## Princeton Enlarges Scope of Engineering School

Princeton has given an undergraduate course in civil engineering and a graduate course in electrical engineering for many years. Next fall under graduate courses in mechanical, electrical, mining and chemical engineering will be added to the curriculum. A four-year course will lead to the degree of B. S. in engineering and is designed to meet the needs of the student who does not expect to practice the profession of engineering but wishes the engineering training to fit him for business or manufacturing. For those who decide to follow engineering as a profession an additional year of special work in the chosen branch will bring the engineer's degree. The establishment of the new courses has been largely due to the efforts of certain of Princeton's engineering alumni through the graduate body known as the Princeton Engineering Association.

Prof. Arthur M. Greene will become head of the Princeton Engineering School in 1922, as already announced.

## Chicago Plans Calumet Harbor

An ordinance passed by the City Council of Chicago provides for developing Lake Calumet as an inland harbor in the southern section of the city. In this shallow lake a deep channel is to be dredged, with slips for vessels, the material excavated being used to form the piers and to fill in a large area of made land for terminal facilities and industrial development. This project was noted in *Engineering News-Record* of April 21, p. 673.

## Seattle Chapter of A.A.E. Favors Skagit Project

On July 15 the members of the Seattle chapter of the American Association of Engineers passed a resolution which was forwarded to the city authorities urging them to complete at the earliest possible date the development of the Gorge Creek unit of the Skagit power project which is in prospect of being held up for lack of funds. A committee was appointed to confer with the municipality or other committees from civic associations for the purpose of spreading information regarding the details and desirability of the project.

## $2,000,000 for N. Y. Street and Other Refuse Disposal

An appropriation of $2,000,000 serial bonds has been made by the Board of Estimate of New York City for the purchase by the street cleaning department of motor trailers, floating equipment, the acquisition of sites for and the construction of water-front and inland refuse reclamation stations and reduction works for dead animals. John P. Leo, commissioner of street cleaning, informs *Engineering News-Record* that, according to present indications, "the amount will be devoted almost entirely to the establishment of reclamation plants." The conclusions of a report on this and related subjects by a committee, of which Commissioner Leo was a member, were given in *Engineering News-Record*, June 30, p. 1135.

## Discuss Plans for Wholesaling Hetch Hetchy Power

Rapid progress in the Hetch Hetchy tunnels for the water supply of San Francisco, Cal., has led to the conclusion that the first block of Hetch Hetchy power, about 66,000 hp., to be developed in the Mocasin Creek plant, will be available in two and a half years. There has been discussion of late between officials of the city and the power company regarding the sale of this block of power in its entirety to the Pacific Gas & Electric Co. John A. Britton, vice-president and general manager of that company, recently made an inspection trip over the project with M. M. O'Shaughnessy, city engineer.

If the company can be assured of this power certain of their development work could be deferred. If the city does not dispose of it wholesale and desires to bring it to San Francisco approximately 150 miles of transmission line would have to be built, after which there would still be the question of a distribution system if the power were to be used for street lighting and industrial service generally.

## Engineers Professional Men in New Railway Classification

A new set of rules, providing for classification of steam railway employees, was put into effect July 1 by the order of the Interstate Commerce Commission to provide statistics intended to meet the needs of both the U. S. Labor Board and the Interstate Commerce Commission. The need of such classification of professional positions was developed at the hearing of the request for increases of salaries for professional engineers conducted by the American Association of Engineers before the Board of Wages and Working Conditions of the U. S. Railroad Administration on April 2, 1919. C. E. Drayer, secretary of A. A. E., makes the following comment on the new classification:

"It is significant that occupational classification has now been made on railroads after careful and scientific study. So far as we know it is the first time in history, not only of this country, but the world over, where anything like two million employees have been classified on an absolutely scientific basis.

"Engineers in railroad employ are definitely put in the professional group. It is a distinct step in advance for the engineer in his striving for recognition to be classed officially on railroads as a professional man.

"It is important that the actual distribution of employees into the official classification now in progress by the railroads be done accurately. The engineer group includes the following distinctive classes of positions:

| GRADE 1: | Symbol |
|---|---|
| Engineering computer | PER-11 |
| Engineering draftsman | PER-12 |
| Instrumentman | PER-13 |
| Junior engineer (civil) | PER-14 |
| Junior engineer (electrical) | PER-15 |
| Junior engineer (mechanical) | PER-16 |
| Leading draftsman | PER-17 |
| GRADE 2: | |
| Assistant engineer (accountant) | PER-21 |
| Assistant engineer (civil) | PER-22 |
| Assistant engineer (electrical or signal) | PER-23 |
| Assistant engineer (mechanical) | PER-24 |
| Assistant engineer (valuation) | PER-25 |
| Chief draftsman | PER-26 |
| Designer and detailer | PER-27 |
| Division engineer (not maintenance of way) | PER-28 |
| Resident engineer | PER-29 |

"Such position as district engineer, engineer of bridges, engineer of signals, engineers of tests, electrical engineer, valuation engineer, engineer of motive power, division engineer and office engineer, in which the preponderant duties are to perform or assist in executive or supervisory work, are included in executive, officials and staff assistant service.

"The classification work was done by J. L. Jacobs and his associates of Chicago, with the co-operation of members of the staff of the U. S. Railway Labor Board."

## Federal Motor Vehicle Tax Proposed in House Bill

### Rate of 40 Cents per Horsepower for Pneumatic-Tired Cars and Scaled Fees for Trucks

Federal licenses and registration fees for both passenger and commercial motor vehicles, in addition to existing state licenses and fees, are provided for in a bill introduced in the House of Representatives, July 28 by Congressman T. Frank Appleby of New Jersey. The bill (H.R.7991) fixes a rate of 40c. per horsepower for vehicles with pneumatic tires and a graduated fee for motor trucks based on carrying capacity.

By the terms of the bill all persons operating automobiles or self-propelled vehicles of any character on the public highways in interstate travel are required to take out a special federal license, which carries with it a federal registration tag forming a part of the state license tag. The federal tag is to be recognized by the authorities of all states as permitting the owner of the automobile to whom the license was issued to operate his machine within the confines of any state without any additional registration or the securing of any other license or the payment of any additional tax. The federal licenses, the bill states, will be issued through the motor commissioners of the various states, and of the fee charged 90 per cent will go to the United States Government, and 10 per cent to the state through which the license is issued.

The bill, its proponents state, is intended to not only simplify and promote interstate travel and commerce by motor vehicles, but also to produce revenue. Congressman Appleby feels that while it will probably bring in an annual revenue of approximately $10,000,000 the law will nevertheless, be welcome to the class upon whom the tax will fall, as they will be glad to pay the small registration fee required in order to escape the petty annoyances with which they are now forced to contend through the conflicting and burdensome motor provisions and regulations of the various states.

Secretary of the Treasury Mellon, appearing before the House ways and means committee this week, advocated a flat federal tax of $10 on every motor vehicle.

## Louisiana to Draft Vehicle Law Changes This Fall

The burden of drafting Louisiana's new motor vehicle law, the basis of which was fixed by the recent constitutional convention, as outlined in last week's issue, will fall upon the State Legislature which will convene in special session Sept. 6. While the constitution does not stipulate what the restrictions shall be as to gross weight of vehicle, weight per inch, width of tire, etc., it is understood that 20,000 lb. for gross weight and 500 lb. per inch width of tire are contemplated.

## Crane of 300 Tons Weight Set in Place by Larger Crane

By W. Mack Angas, Lieut. C.E.C. U. S. N., and E. M. Bredin
Public Works Dept., U. S. N.

A traveling hammerhead crane weighing 300 tons was lifted and swung over to place recently by the 350-ton revolving crane on the fitting-out pier of the Philadelphia Navy Yard. It was the heaviest load yet handled in the course of actual work by the big crane.

The 350-ton crane, described in *Engineering News-Record*, Jan. 22, 1920, p. 172, is located 600 ft. from the shore end of the new 1,000-ft. fitting-out pier; and the traveling crane which was the load in the somewhat spectacular lift mentioned is intended for use on the part of the pier lying between the shore and the big crane. Tracks for the traveling crane have been laid, however, on both the outboard and inboard parts of the pier and arrangements provided for the big machine to lift its "assistant" round from one part of the pier to the other when necessary. The traveling crane is of the revolving hammerhead pintle type.

BIG NAVY YARD CRANE SWINGING TO PLACE ASSISTANT CRANE OF 200 TONS

It was necessary to erect the traveling crane on the tracks lying out beyond the big crane so as not to block the railroad approaches to that machine and interfere with the fitting out of the hospital ship "Relief." After completion of the traveling crane by the contractor and a preliminary test, the upper part of the fixed (*i.e.*, nonrotating) tower was strengthened so that the entire crane could be safely suspended from the four upper corners of the tower. Forged steel links were connected to the structure at these points by bridge pins and to them were shackled pendants consisting of double 2¼-in. steel cables slung from the equalizer hook on the two main hoists of the 350-ton crane. All rigging was arranged so that the load would automatically equalize itself on the eight cables that supported it and all lifting tackle was tested with a 50 per cent overload before being used.

The transfer of the traveling crane from the outboard to the inboard tracks was accomplished in ¾ hr.

## Hoover Urges Fall Letting of Highway Contracts

In a letter to the Governors of various states, dated July 26, Herbert Hoover, Secretary of Commerce, suggests that greater economy and more evenly balanced employment would result from fall instead of spring awards of highway construction contracts. The text of Secretary Hoover's communication follows:

"In making a systematic study as to what we can all do to promote employment and to thus assist in tiding over the very severe situation that we are now in, this department has had its attention called to the bearing of the period at which contracts are currently let for the building of public roads upon this problem. In order that there should be no question as to the correctness of the conclusions that had been reached, I summoned a committee comprising representatives of the great engineering societies who have prepared for me the enclosed opinion.

"The conclusions of this inquiry are, in a word, that there would be additional economy in construction if the contracts for the roads were let in the fall instead of in the winter and spring; that contracts let at this time would enable considerable employment over the winter in the manufacture of material and equipment and in the placing of material ready for construction early in the spring. It would enable contractors to give employment to some of their staffs through the winter instead of imposing it at a higher rate upon the short summer construction season. It would relieve pressure on labor during the period of larger demand for agricultural help and would, indeed, expedite the completion of road building.

"The criticism that we are in a period of falling prices and possibly of railroad rates, and that contracts let this fall might be at higher figures than would prove necessary later in the season may be answered by making provisional contracts so that any such difference would accrue to the state. This method has been partially adopted in a few states and you will, of course, understand that my only desire is to offer a suggestion that co-operative action might lead to some reduction of unemployment."

## Tentative Valuations Issued

Additional tentative valuations announced by the Interstate Commerce Commission include the properties of the Toledo, St. Louis & Western R.R., the Western Pacific Ry., and the Ann Arbor R.R. In each case, as in the "supplemental tentative valuations," the reports include a single sum as "final value" and a separate statement of additional cost of acquiring carrier lands due to condemnation and damages.

The final value of the properties owned and used by the Toledo, St. Louis & Western R.R. for purposes of transportation is given as $17,282,977; cost of reproduction new, $16,742,614, and cost of reproduction less depreciation, $12,980,050. Outstanding capitalization as of valuation date was $48,412,413 and the investment account, $39,339,257.

Final value of the Western Pacific Ry. (properties wholly owned and used for transportation) is reported as $66,061,208; cost of reproduction new, $61,577,074. The investment account up until valuation date was $156,318,136.

Final value of properties wholly owned and used for purposes of transportation by the Ann Arbor R.R. is given as $11,046,455. Capitalization outstanding as of date of valuation was $17,271,538.

Tentative valuations have also been issued on the following properties with final values of properties wholly owned and used for purposes of transportation as indicated:

| | |
|---|---|
| Central R.R. of Oregon | $106,882 |
| Menominee & St. Paul Ry. | 50,000 |
| Grand Canyon Ry. | 1,179,824 |
| St. Joaquin & Eastern R.R. | 1,148,000 |
| Blaney & Southern Ry. | 56,000 |
| Sunset Ry. | 1,361,298 |
| Lithonia & Arabia Mountain Ry. | 47,000 |
| Chicago, Milwaukee & Gary Ry. | 2,889,475 |
| Milstead R.R. | 31,706 |
| Trinity & Brazos Valley Ry. | 9,064,056 |
| Montana Western Ry. | 186,500 |
| White River R.R. | 392,223 |
| Gulf, Texas & Western Ry. | 1,667,771 |
| South Manchester R.R. | 171,188 |
| Peoria Ry. Terminal Co. | 1,122,306 |
| Mount Hood R.R. | 507,032 |
| Gideon & North Island R.R. | 108,600 |
| Garden City Western Ry. | 192,057 |
| St. Louis-South Western Ry. | 23,831,830 |
| Stephenville, North & South Texas Ry. | 2,150,000 |
| Washington & Choctaw Ry. | 147,865 |
| Sardis & Delta R.R. | 116,000 |
| Timpson & Henderson Ry. | 390,000 |

### Committee Studies Highway Bills

(*Washington Correspondence*)

After a general discussion of the two highway bills by the full committee on post offices and post roads, it was decided to allow a few days for the individual members of the committee to study the two measures. It was decided to report out the bill which already has passed the House with such amendments as may be agreed upon. It was hoped that such an agreement would be reached early in August. Senator Townsend, the chairman of the committee, declared that everything would be done to expedite the consideration of the amended bill by the Senate, regardless of the fact that it may be impossible to secure the appropriation which the bill would authorize.

### Doty Heads Licensing Board

Paul Doty, of St. Paul, has been elected chairman of the Minnesota board of registration for architects, engineers and land surveyors. H. T. Downs, of Minneapolis, is secretary-treasurer and N. Y. Taylor, Litchfield, vice-chairman. The other members of the board are F. W. McKellip, Fairbault; F. G. Gorman, Duluth; A. F. Gauger, St. Paul, and Dwight E. Woodbridge, Duluth.

## PERSONAL NOTES

ARTHUR E. MORGAN has resigned as chief engineer of the Miami Conservancy District, effective Sept. 1 and will be succeeded by Charles H. Paul, who is at present assistant chief engineer. Mr. Morgan will divide his time between his engineering practice with the Dayton Morgan Engineering Co., Dayton, Ohio, and the work he has undertaken, as president, in the reorganization of Antioch College at Yellow Springs, Ohio.

E. A. VAN DUSEN, for the past two years with the Fargo Engineering Co., Jackson, Mich., as structural and hydraulic engineer on design and reports for hydro-electric developments, has resigned to accept a similar position with the Power Construction Co. (New England Power Co.), Worcester, Mass.

J. A. GRANT, formerly chief of field engineering on the construction of the Wilson dam, Muscle Shoals, Ala., is now engaged in hydraulic design work on the reconstruction of works in Pueblo, Col.

JEREMIAH C. FINCH, recently assistant to First Deputy Fred W. Sarr and chief of the bureau of plans and surveys, has been appointed secretary of the New York State Highway Commission.

F. P. KEMON, construction superintendent for Terry & Tench Co., Inc., has been transferred to Washington, D. C., on the work of underpinning the Lincoln Memorial.

THE WYCKOFF ENGINEERING CORP., New York City, has been organized by M. M. Wyckoff, formerly engineer, construction superintendent and general purchasing agent for the T. A. Gillespie Co., to engage in the general practice of engineering and contracting.

CHARLES N. MONSARRAT, who resigned about two months ago as consulting engineer to the Department of Railways and Canals of the Canadian Government to enter private engineering practice with P. L. Pratley, with offices in Montreal, has been appointed consulting engineer of bridges, Canadian National Rys. and the Grand Trunk Pacific Ry. He will continue his private practice and devote a portion of his time to the railway consulting work.

NORMAN J. HOWARD, bacteriologist in charge of the filtration plant laboratories, Toronto, Ont., has sailed for England and Ireland where he will visit Birmingham, Manchester and other cities to observe what progress has been made in the activated sludge method of sewage disposal.

O. MINER LELAND, for many years a member of the engineering faculty of Cornell University, is now dean of the engineering department of the University of Minnesota.

MORTIMER W. SMITH, JR., twice engineer of Broad Oaks, W. Va., now a part of the city of Clarksburg, and at one time deputy county surveyor of Harrison County, has been appointed assistant city engineer of Clarksburg.

CEDRIC A. MARTIN has been appointed construction engineer for the City of Puyallup, Wash., on contemplated sewer and paving work. He served several years on construction and valuation for the Northern Pacific Ry., on railway valuation with the Interstate Commerce Commission, as county engineer of Franklin County, Wash., and as surveyor in Idaho for the U. S. Forest Service.

BENJAMIN BEAN, an employee of the California Highway Commission for seven years and for the past eight months computor with the Bureau of Valuation of the Interstate Commerce Commission, Kansas City, Mo., has been appointed field engineer with the State of Missouri on project No. 99, Clay County, on federal-aid highway construction.

CHARLES E. JONES, formerly superintendent of construction, U. S. Engineer Department, on Lock 4, Allegheny River, has been transferred as superintendent of construction to Lock 6, Monongahela River.

MURRAY & FLOOD is a firm recently organized, with offices in New York, by William S. Murray, formerly chairman of the Super-power Survey and Henry Flood, Jr., formerly engineer-secretary of the Super-power Survey.

FLOYD E. RICHEY has been appointed checker of materials at the U. S. Public Health Service Hospital, Whipple Barracks, Prescott, Ariz., now under construction.

DR. MILLER R. HUTCHISON, who served as chief engineer and personal representative to Thomas A. Edison, has been elected president of an organization to investigate and develop inventions, with offices in New York City. Among those associated with him are Hudson Maxim and Sir Edgar Rees Jones.

CARL R. GRAY, president of the Union Pacific Co., has been elected president of the Los Angeles and Salt Lake R.R.

## OBITUARY

DR. W. E. STONE, president of Purdue University, Lafayette, Ind., was killed in a fall on Mount Eon, Alberta, Canada, July 27, in an effort to rescue his wife, who had fallen to a narrow ledge on the face of a deep crevice. Dr. and Mrs. Stone were experienced mountain climbers and had left Banff, Alberta, on July 15 to attempt the ascent of Mount Eon. Dr. Stone was born in Chesterfield, N. H., in 1862, and received the degree of B.S. from Massachusetts Agricultural College, 1882; B.S., Boston University, 1886; Ph.D., Göttingen, 1888, and LL.D., Michigan State Agricultural College, 1907. He was assistant chemist at the Massachusetts State Agricultural Experiment Station for about two years and later became chemist of the Tennessee Agricultural Experiment Station. In 1889 he joined the faculty of Purdue University as professor of chemistry. He later became vice-president and in 1900 president of the university. He was a member of the Indiana State Board of Education.

MAJOR L. A. FISCHER, chief of the division of weights and measures, U. S. Bureau of Standards, died July 20 in Washington, D. C. He was born in Washington in 1864 and was a lifelong resident of that city. He was graduated from George Washington University with the degree of B.S. in 1864. He was a leader of the movement to promote a uniform system of weights and measures in the United States and was author of a history of weights and measures (1905). In 1904 he compiled the laws relating to weights and measures in the United States.

W. L. LOGAN, bridge department, Illinois Central R.R., Council Bluffs, Iowa, was accidentally drowned in the Missouri River July 1, 1921, according to all available evidence. He was a graduate in civil engineering, Purdue University, 1915, and had been in the bridge department of the Illinois Central for the past six years. At the time of his death he was supervising the construction of retards in the Missouri River, about three miles north of Council Bluffs.

# Business Side of Construction

*Facts and Events that Affect Cost and Volume*

## Building Survey Made by Philadelphia Housing Association

New York and Los Angeles are two cities of over 500,000 population that are nearly providing for the normal increase in their populations, according to a survey recently made by the Philadelphia Housing Association. Examination of the building permits issued in principal cities of the United States shows that during the first six months of 1921 New York provided for 90 per cent of the normal yearly increase in population, and Los Angeles 92 per cent. Other cities provided the following percentages of normal yearly increases: Cleveland, 40 per cent; Pittsburgh, 34 per cent; Chicago and San Francisco, 32 per cent; Detroit, 27 per cent, and Philadelphia, 13 per cent.

Information was also gathered upon the amount of construction undertaken for the first six months of 1921, as compared to the corresponding period of 1920. Boston shows a gain in permits for the first half year of 120 per cent, Chicago, 107 per cent, St. Louis 116 per cent, Los Angeles 92 per cent, San Francisco 70 per cent, and Cleveland 30 per cent. For a four months' period New York shows an increase in permits of 33 per cent and a gain in provisions for families of 182 per cent. In Philadelphia there was a loss of 41 per cent in permits and 47 per cent in families provided for.

### New Construction Funds

Of the large cities four show a decrease in funds going into new construction in 1921 over 1920. In six cities there is an increase. Pittsburgh reported a decline of 32 per cent in funds going into new dwellings, Baltimore 26 per cent, Detroit 25 per cent, Philadelphia 64 per cent. A gain in funds devoted to new dwellings in the first part of 1921 over the same period of 1920 was 31 per cent in Boston, 39 per cent in Cleveland, 42 per cent in Los Angeles, 111 per cent in San Francisco, 143 per cent in New York, and 167 per cent in St. Louis.

Increases in the amount of money going into construction of all kinds during the first half year of 1921 over 1920 were reported as follows: Los Angeles, 41 per cent; Chicago, 4 per cent, and New York, 10 per cent. Other cities decreased their total value in buildings of all kinds—factories, garages, theaters, public buildings, etc.—decreases being: For Baltimore, 9 per cent; Pittsburgh, 17 per cent; San Francisco, 24 per cent; Boston, 32 per cent; Cleveland, 34 per cent; St. Louis, 40 per cent; Detroit, 40 per cent.; Philadelphia, 55 per cent.

Thus the housing association finds that Philadelphia is at the bottom of the list of cities of over 500,000 population as regards housing.

## New Labor Body Announced

Believing that the extremely militant attitude of a great many labor leaders is harmful to the cause of labor, that old-time methods must be discarded as having outlived their usefulness and that an entire new system of handling disputes between wage earners and employees must be practiced, several officers of various organizations within the American Federation of Labor have announced the formation of the Loyal Labor Legion of New York City. F. P. A. Vacarelli, former vice-president of the International Longshoremen's Association, is the head of the new organization, which, according to a statement issued by Mr. Vacarelli, grew out of a meeting of the Loyal Labor Legion last Friday night when a new constitution embodying the latest ideas on labor was adopted. It is said that 90 per cent of the organization's membership is composed of elected officials of American Federation of Labor trade unions.

Four clauses which carry distinctly new notes in the attitude of labor toward capital and the public provide that the Loyal Labor Legion recognizes: (1) The right of men and women to work regardless of membership or non-membership in trade unions; (2) the rights of the general public as a party at interest in labor controversies; (3) the necessity for laws establishing courts of arbitration with powers to enforce obedience to their decisions; (4) the settling of differences between employers and wage earners without intervention by persons not personally affected by the matter in controversy.

In his statement Mr. Vacarelli asserts that a great deal of the present unemployment may be laid "to the unwise leadership of men who ran amuck and called hundreds of strikes immediately following the war. When the greatest need was increased production, reckless labor leaders encouraged their followers to make impossible demands compelling hundreds of plants to close."

"Organized labor," continues the statement, "needs a new birth. The doctrine of peace and prosperity must displace that of rule or ruin. New membership and new vision must enter the A. F. of L. from top to bottom and principles and methods accepted that will bring peaceful agreements and reasonable bases rather than destructive warfare for unobtainable demands."

## Pennsylvania Highway Work

So far during 1921 the Pennsylvania State Highway Department has completed the construction of 281 miles of durable roadway into which concrete enters in some form. The maintenance forces of the department during 1921 have entirely resurfaced 104 miles of waterbound macadam and have put down 207 miles of unbound macadam.

## Contracts Let During July Total $106,011,049

### Miscellaneous Building and Street and Road Work 75 Per Cent of Total—Public Works Building Active

The total value of contracts let during July as reported in *Engineering News-Record* was $106,011,049, or close to 80 per cent of the total amount of money involved in contracts let during the corresponding period of 1920. Miscellaneous building construction leads for July with street and road work a close second, the total value of these two types of construction being in the neighborhood of $79,000,000 or 75 per cent of the total for the month. *Engineering News-Record* does not report on contracts let for residential building.

Both miscellaneous building and street and road work were considerably more active during July of 1921 than during July of 1920. Other classifications of construction also exceeded last year, the only wide disparity between 1921 and 1920 in favor of the latter being in industrial work. The industrial contracts let during July, 1920, totaled approximately $31,000,000, whereas during July, 1921, they were little in excess of $6,500,000.

VALUE OF CONTRACTS LET DURING JULY OF 1920 AND 1921

| | July, 1920 | July, 1921 |
|---|---|---|
| Waterworks | $3,793,237 | $3,105,969 |
| Sewers | 3,162,632 | 3,985,791 |
| Bridges | 3,657,615 | 5,053,320 |
| Streets—roads | 29,352,756 | 33,942,893 |
| Excavation | 1,941,897 | 609,233 |
| Industrial | 30,968,900 | 6,781,369 |
| Buildings | 38,947,190 | 45,452,153 |
| Federal Government | 4,431,976 | 3,382,964 |
| Miscellaneous | 13,028,267 | 3,696,957 |
| Total | $129,284,470 | $106,011,049 |

Though the total value of contracts let during July of this year is also about 80 per cent of that of July, 1920, when actual dollars are compared, the two figures are found to correspond almost exactly when the decrease in the cost of construction during the past year is taken into account. *Engineering News-Record's* construction cost index figure published in the issue of July 21, p. 127, shows this reduction to be in the neighborhood of 18 per cent. Applying this differential the respective figures representing the total contract value for the two years are: 1920, $129,284,470; and 1921, $128,727,702.

Again, taking the construction cost index number into account, it is found that the value of a construction dollar during 1920 was 42c., whereas for July, 1921, it is 51c. Reducing these two figures to a 1913 base, the figures representing the total contract values become, approximately: 1920, $54,000,000; 1921, $53,000,000.

The total value of contracts let for

the first seven months of 1921 is therefore approximately $685,000,000. This figure compares with $1,097,970,327 for the first seven months of 1920. Applying the 18 per cent difference in construction costs for the two years the 1921 figure is raised to more than $800,000,000 for the first seven months, when compared to 1920.

## Ohio Lets Highway Work Worth $1,847,907

During the past week the Ohio State Highway Department let road contracts worth $1,847,907. Of this amount $1,775,008 is for the construction of highways of various types and the remainder is for the construction of bridges. The total mileage involved in the thirty contracts which were awarded for highway construction is in excess of 61 miles, divided among the following types: Brick, 16 miles, bituminous macadam, 16 miles; concrete, 9 miles; waterbound macadam, 10 miles. The mileage involved in contracts for only grading and installation of drainage structures was in excess of 13 miles.

## Gompers Urges Plan to Decrease Seasonal Employment

Samuel Gompers, president of the American Federation of Labor, recently urged upon President Harding the advisability of the government taking into consideration all the conditions of the labor market before initiating any public construction. Mr. Gompers asserted that much inconvenience and actual loss could be avoided if construction of public works were undertaken at times when private construction did not furnish sufficient employment for wage-earning classes. The suggestion, he said, was particularly applicable to the seasonal occupations.

## West Coast Lumber Production

In the week ending July 23, 105 mills in western Oregon and western Washington reported a lumber production of 50,584,143 ft. b.m., which is 34 per cent below normal production. New business totaled in excess of 43,000,000 ft. b.m. and shipments approximately 49,000,000 ft. b.m. The local business totaled 3,623,267 ft. b.m.

## June Employment Conditions

Fewer engineers by 304 made application of the American Association of Engineers for positions in June than in May, although the number was still nearly twice as many as in 1920. Comparative statistics follow:

| | May, 1921 | June, 1921 | June, 1926 |
|---|---|---|---|
| Applicants | 2,264 | 1,960 | 1,062 |
| Positions received | 406 | 351 | 499 |
| Men referred | 2,788 | 2,419 | 2,632 |
| Men placed | 214 | 195 | 283 |

The average monthly salary for positions filled in June was $185, $5 more than in May. Nine positions paying more than $5,000 per year were filled.

## Southern Pine Production 73 Per Cent of Normal

Southern pine production, according to a report made to the Southern Pine Association by 139 mills was 73 per cent of normal production for the week ended July 22. The total production of these mills was almost 69,000,000 ft. b.m., or an average of 494,000 ft. b.m. per mill. The normal production of

# Labor Rates and Conditions Throughout the Country

Actual changes in schedule are reported by three of the nineteen cities which keep us informed monthly as to labor rates and conditions. In Birmingham carpenters now receive 75c. per hour, as against the former rate of 87½c., while common labor is paid as low as 15c. an hour. Hod-carriers, formerly receiving 25 to 40c., are now paid the lower rate. Certain adjustments have been made in New Orleans; as a result of arbitration the rate for carpenters is now 88c., as against $1. The hoisting engineers waived arbitration and by negotiation have accepted a 10 per cent reduction, to 90c. per hour. By a voluntary offer by the pile-drivers 80c. is now paid for that class of labor, as against $1. Common labor is receiving 30c. and less, as against the former rate of 50c. In Los Angeles common labor is paid $4.50 per day, whereas the former rate was 75c. per hour. Despite this reduction there is a large surplus of common labor. In the case of the skilled crafts, work is fairly plentiful, with residence building particularly brisk. There is a good demand for pile-drivers, but hoisting engineers find difficulty in obtaining employment in their trade.

Detroit reports no change in labor rates, although on some jobs men are accepting less than the established scale. Few new construction jobs are going forward, and the volume in prospect appears to be decreasing. All classes of labor are plentiful. Minneapolis reports labor plentiful, as elsewhere, with noticeable unemployment continuing in the building trades. The schedule is the same as last month, and the bricklayers' union has notified the city building inspector that effective July 15 it will recognize the current rate of $1 per hour. This rate was announced by the employers' association and made effective May 1.

S means scarce; E, enough; P, plentiful—Higher rates indicated by +, decreases by—

| Cities | Bricklayers | Carpenters | Hoisting Engineers | Hod Carriers | Pile Drivers | Structural Iron Workers | Common Labor |
|---|---|---|---|---|---|---|---|
| Atlanta | $0.90P | $0.70P | $1.00P | $0.30P | ..... | $1.00P | $20@25P |
| Baltimore | 1.25P | .80P | .87½P | .54P | $0.74P | 1.00P | .35P |
| Birmingham | 1.00P | .75P | ..... | .25 | ..... | 1.00P | .15@.25 |
| Boston | .90P | .90P | .90P | .60P | .90P | .90P | .55P |
| Cincinnati | 1.25P | 1.00P | .70E | .85P | 1.00E | 1.25P | .35@.40 |
| Chicago | 1.25 | 1.25 | ..... | ..... | ..... | 1.25 | 1.00 |
| Cleveland | 1.25P | 1.25P | 1.25P | .87½P | 1.10P | 1.25P | .87½P |
| Dallas | 1.00P | 1.00P | 1.00E | .60E | 1.00E | 1.00E | .50@75P |
| Denver | 1.37½ | 1.00 | 1.00 | .75@.81¼ | 1.00 | 1.00 | .37½@50P |
| Detroit | 1.00P | .80P | .80@.90P | .50@.60P | 1.00P | .60@.80P | .50P |
| Kansas City | 1.07½ | 1.00 | 1.00 | .80 | 1.07½ | 1.07½ | .70 |
| Los Angeles | 1.25P | 1.00P | 1.00P | 1.12½P | 1.00P | 1.00P | —.56¼P |
| Minneapolis | 1.00P | .80P | .80P | .65P | ..... | .80P | .50P |
| Montreal | .90P | .65P | .60P | .40P | .50P | .65P | .30P |
| New Orleans | 1.00P | —.88P | —.90P | .40P | —.80P | 1.00P | .30P |
| New York | 1.25 | 1.12½ | 1.25 | .87½ | 1.12½ | 1.12½ | .75@.80 |
| Pittsburgh | 1.12½P | 1.00P | 1.00P | .80P | ..... | 1.00P | Open |
| St. Louis | 1.25P | 1.25P | 1.25P | .85P | 1.25P | 1.25P | .67½P |
| San Francisco | 1.25P | 1.12½P | 1.12½P | 1.00P | 1.12½P | 1.12½P | .81¼P |
| Seattle | 1.00P | .80P | .80P | .70P | 1.00P | .87½P | .50P |

these mills is 93,837,246 ft. b.m., or an average per mill of 675,000 ft. b.m. The orders on hand at the beginning of the week ended July 22 amounted to 196,000,000 ft. b.m., and the orders received during the week were 67,000,000 ft. b.m., or a total of 263,000,000 ft. b.m. The shipments during the week amounted to a little more than 69,000,000 ft. b.m., or 2,000,000 ft. b.m. more than the orders received during the week.

## Committee on Waste Elimination Reports on Metal Trades

About $1,000,000,000 is the annual waste in the metal trades industry attributable to idle men and machinery, according to the report of the Committee on Elimination of Waste in Industry of the Engineering Council. This loss is for labor only and takes no account of the value of material produced were productivity increased.

Instability of labor and incompetent management, says the report, are the chief factors contributing to the loss. The average waste due to avoidable labor turnover is estimated at $100,000,000 annually. The report urges that modern employment methods, with particular attention paid to why men quit work, be studied.

The report is part of the general report made by the committee in its national survey of industrial waste, directed by L. W. Wallace, of Washington. The metal trades investigation was in charge of Fred. J. Miller, of New York, former president of the American Society of Mechanical Engineers, and by William B. Ferguson, of Philadelphia.

**Engineering News-Record Construction Cost Index Number**

*(See Issue of July 21, p. 127)*

| | |
|---|---|
| Aug. 1, 1921 | 193.47 |
| July 1, 1921 | 203.82 |
| Aug. 1, 1920 | 251.40 |
| 1913 | 100.00 |

## Building Material Prices in Britain

*(London Correspondence)*

There has been a considerable decrease in the selling price of a number of building materials from the peak reached during the spring of 1920, though some materials were higher in May of this year than during the general high point reached last year, such materials including cement and brick. The following table indicates the comparative prices of several materials:

The prices herein quoted have been made on the basis of a normal exchange, the real quotations being given, in pounds sterling, shillings and pence.

| Commodity | Price on July, 1914 | Price on Feb., 1920 | Price on May, 1921 |
|---|---|---|---|
| Sand, per cubic yard | $0.98 | $5.70 | $5.34 |
| Brick, per thousand | 8.22 | 15.19 | 18.67 |
| Portland cement, per ton | 8.94 | 18.91 | 21.24 |
| Thames ballast, per cubic yard | 1.40 | 4.74 | 4.20 |
| Raw Linseed oil, per gallon | 0.52 | 2.51 | 0.74 |
| Red lead, per ton | 138.48 | 338.94 | 208.32 |

## Conditions in the Brick Industry

Over-competition prevails quite generally in the brick industry according to the monthly digest issued by the common Brick Manufacturers' Association of America. The composite price as revealed by reports of nearly 100 manufacturers representing every important brick producing center was $14.49 on July 1 as against $15.14 on June 1. The composite price means little except that it indicates the general trend. Brick is selling from $9 per thousand in the Southeastern States and in Texas to $25 per thousand. The low price is not general even in those sections, but is the extreme result of competition which the digest characterizes as "thoughtless and unbusinesslike." The number of brick plants closed is about the same as was reported during June. There is plenty of material, quotes the digest, and labor is plentiful and fairly efficient.

"Practically all the plants closed," says the digest, "are railroad yards dependent upon rail for shipment to market and the prohibitive freight rates eliminate them. More brick than ever before is being delivered from plant to job by truck. The railroads will permanently lose much of this tonnage."

# Monthly Prices of Construction Materials

## *Ups and Downs of the Market*

**Railway Material**—This month we quote light rails at $45 per ton for all weights. Ties are down 5 to 10c. each in St. Louis. Standard spikes can be bought at $3 per 100 lb., Pittsburgh mill, and are down also in St. Louis.

**Pipe**—The July 7 basing card for wrought pipe shows the steel discounts 2 per cent greater than last month, while the discounts on wrought-iron pipe are 6 per cent higher. Discounts in New York warehouse are 6 per cent higher on 1@3 in. butt-welded steel pipe, and 2 per cent higher on 3½@6 in. lap-welded. There are several adjustments in cast-iron quotations. St. Louis reports a heavy increase on clay drain tile, and submits no explanation at this time. Sewer pipe has advanced in St. Louis, but is down in Los Angeles, Cincinnati and Atlanta. Contracts let for cast-iron pipe in July, according to the Construction News section of *Engineering News-Record*, amounted to $1,168,000.

**Paving Material**—Road oils have declined about 1c. per gal. in New York; with asphalt in packages $4 lower than last month and in bulk $1 lower per ton. Asphalt is down also in Minneapolis, Atlanta and Cincinnati. Cincinnati reports that granite blocks now cost $4.50 per sq.yd., as against $4.25 last month. The demand for curbing in the New York district is greater than present production capacity, with the result that bluestone has advanced 10 per cent over last month's quotations. Wood-block paving is down in New Orleans up in St. Louis.

**Sand, Gravel and Crushed Stone**—Gravel is 25c. per cu.yd. cheaper in New York than a month ago. Reductions are reported also in Cincinnati and St. Louis.

**Lime**—Hydrated finishing down in New York, St. Louis, Boston, Montreal and New Orleans, hydrated common down in Boston and Atlanta and advanced 50c. per ton in New Orleans. Lump finishing 20c. higher in Minneapolis and 40c. in Atlanta (180 lb.bbl.). Common lump down in Cincinnati. Minneapolis and New Orleans report rise.

**Cement**—The situation in New York remains as reported last week, with the price $2.60 to $2.70 net, delivered, while the price at the mill supplying New York is $2.10, and $2.80 alongside dock, including four bags at 10c. each. Down in St. Louis, New Orleans and Los Angeles. Rosendale cement reported lower in Boston.

**Common Brick and Hollow Tile**—Common brick down in Boston and Atlanta, and slightly firmer in Cincinnati. Hollow tile slightly lower in Boston, Cincinnati and Atlanta, while a slight advance is reported in New Orleans.

**Roofing Materials**—Market continues steady on roofing materials.

**Structural Material**—Reduction in steel continues with present mill base for structural shapes $1.85. Warehouses are reflecting the decrease, the New York base price being $2.88 delivered; for St. Louis $3.12½, for San Francisco $4.15. Rivets are now $2.65 Pittsburgh mill, and $4.40 New York, delivered.

**Steel Sheetpiling**—Current price $2 Francisco and New York.

**White and Red Lead**—First change since March occurred last week when price was reduced ½c. per lb.

**Lumber**—Decrease of $1 to $3 in St. Louis. Sharp decline in New Orleans, Cincinnati and Montreal.

**Steel Sheetpiling**—Current price $2 per 100 lb., Pittsburgh.

**Wire Rope**—Fairly general decrease of 5 per cent.

**Manila Rope**—Tendency downward.

**Wood Piles**—Larger sizes $2 to $4, cheaper, New York.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Quotations compiled by The Matthew Addy Co.:

| | Current | One Year Ago |
|---|---|---|
| CINCINNATI | | |
| No. 2 Southern (silicon 2.25 @ 2.75) | $24.50 | $45.60 |
| Northern Basic | *19.00* | 42.80 |
| Southern Ohio No. 2 (silicon 1.75 @ 2.25) | *22.52* | 46.80 |
| NEW YORK, tidewater delivery | | |
| Southern No. 2 (silicon 2.25 @ 2.75) | *30.26* | 49.70 |
| BIRMINGHAM | | |
| No. 2 Foundry (silicon 2.25 @ 2.75) | *20.00* | 42.00@44.00 |
| PHILADELPHIA | | |
| Eastern Pa., No. 2X, (2.25@2.75 sil.) | *22.50* | 46.00@48.25* |
| Virginia No. 2 (silicon 2.25 @ 2.75) | *29.74** | 45.00* |
| Basic | *21.50*† | 44.50† |
| Grey Forge | *21.50* | 43.50* |
| CHICAGO | | |
| No. 2 Foundry Local (silicon 1.75 @ 2.25) | *20.00* | 45.00 |
| No. 2 Foundry Southern (silicon 2.25 @ 2.75) | *26.66* | 48.70 |
| PITTSBURGH, including freight charge from the Valley | | |
| No. 2 Foundry Valley (silicon 1.75 @ 2.25) | *22.00* | 45.65 |
| Basic | *20.50* | 44.40 |
| Bessemer | *22.50* | 44.90 |

*F.o.b. furnace. † Delivered.

## RAILWAY SUPPLIES

**STEEL RAILS**—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb is charged extra:

| | Pittsburgh | | | |
|---|---|---|---|---|
| | Current | One Year Ago | Birmingham | Chicago |
| Standard bessemer rails | $45.00 | $45.00@60.00 | ..... | $45.00 |
| Standard openhearth rails | 47.00 | 47.00@62.00 | $47.50 | 47.00 |
| Light rails, 8 to 10 lb | 45.00 | 50.00@55.00 | ..... | 2.45@3.00* |
| Light rails, 12 to 14 lb | 45.00 | 50.00@55.00 | 2.20* | 2.41@2.95* |
| Light rails, 25 to 45 lb | 40.00 | 50.00@55.00 | 2.20* | 2.32@2.85* |

*Per 100 lb.

**RAILWAY TIES**—For fair-sized orders, the following prices per tie hold:

| | 6 In. x 8 In. by 8½ Ft. | 7 In. x 9 In. by 8 Ft. 6 In. |
|---|---|---|
| Chicago, White Oak | $1.85@$1.40 | $1.45@$1.50 |
| Chicago, Hardwood and Red Oak | 1.25@ 1.30 | 1.40@ 1.45 |
| Chicago, Empty Cell Creosoting (add'l) | .45 | .50 |
| San Francisco, Green Douglas Fir | .80 | 1.12 |
| San Francisco, Empty Cell Creosoted, Douglas Fir | 1.76 | 2.48 |

For ties on standard "railroad administration" specifications, f.o.b. cars, St. Louis:

| | White Oak | Red Oak | Pine and Sap Cypress |
|---|---|---|---|
| Grade 3 | *$1.25* | *$1.05* | *$.90* |
| Grade 2 | *1.15* | *1.00* | *.80* |
| Grade 1 | *1.10* | .95 | *.70* |

**TRACK SUPPLIES**—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

| | Pittsburgh | | | | | |
|---|---|---|---|---|---|---|
| | Current | One Year Ago | Chicago | St. Louis | San Francisco | Birmingham |
| Standard spikes, ⅜-in. and larger | $3.00 | $4.00@4.25 | $3.40 | *$4.00* | $5.70 | 4.05 |
| Track bolts | 4.00 | 6.00@6.50 | 4.60 | *5.00* | 6.65 | 4.15 |
| Standard section angle bars | 2.75 | 3.00@4.00 | 2.75 | 3.25 | 4.50 | 3.25 |

## PIPE

**WROUGHT PIPE**—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

| Inches | Steel Black | Steel Galv. | Inches | Iron Black | Iron Galv. |
|---|---|---|---|---|---|
| 1 to 3 | *64½* | *52* | ⅜ to 1½ | *39½* | *24½* |

LAP WELD

| | | | | | |
|---|---|---|---|---|---|
| 2 | *56½* | *44* | 15 | *42½* | 32 |
| 2½ to 6 | *60½* | *48* | 2 | *34½* | *20½* |
| 7 to 12 | *57½* | *44* | 2½ to 6 | *37½* | *24½* |
| 13 and 14 | 45 | 37 | 7 to 12 | *35½* | *22½* |

BUTT WELD, EXTRA STRONG, PLAIN ENDS

| | | | | | |
|---|---|---|---|---|---|
| 1 to 1½ | *62½* | *51* | 1 to 1½ | *39½* | *25½* |
| 2 to 3 | *63½* | *52* | | | |

LAP WELD, EXTRA STRONG, PLAIN ENDS

| | | | | | |
|---|---|---|---|---|---|
| 2 | *54½* | *43* | 2 | *35½* | *22½* |
| 2½ to 4 | *58½* | *47* | 2½ to 4 | *38½* | *26½* |
| 4½ to 6 | *57½* | *46* | 4½ to 6 | *37½* | *25½* |
| 7 to 8 | *53½* | *40* | 7 to 8 | *30½* | *18½* |
| 9 to 12 | *48½* | *35* | 9 to 12 | *25½* | *13½* |

**STEEL**—From warehouses at the places named the following discounts hold for steel pipe:

| | Black | | |
|---|---|---|---|
| | New York | Chicago | St. Louis |
| 1 to 3 in. butt welded | *60%* | *62½%* | *52½%* |
| 3½ to 6 in. lap welded | *51%* | *48½%* | *48½%* |

| | Galvanized | | |
|---|---|---|---|
| | New York | Chicago | St. Louis |
| 1 to 3 in. butt welded | *46%* | 50% | 38½% |
| 3½ to 6 in. lap welded | *37%* | 46% | 34½% |

Malleable fittings, Class B and C, from New York stock sell at net list prices. Cast iron, standard sizes, 20—5% off.

**CAST-IRON PIPE**—The following are prices per net ton for carload lots:

| | New York | | | | | |
|---|---|---|---|---|---|---|
| | Current | One Year Ago | Birmingham | Chicago | St. Louis | San Francisco |
| 4 in. | $53.30 | $79.30 | **$58.00** | *$51.10* | **$49.70** | *$73.00* |
| 6 in. and over | 48.30 | 76.30 | **51.00** | *48.10* | **46.70** | *70.00* |

Gas pipe and Class "A," $3 per ton extra; 16-ft. lengths, $1 per ton.

**CLAY DRAIN TILE**—The following prices are per 1000 lin.ft.:

| | New York | | | | | |
|---|---|---|---|---|---|---|
| Size, In. | Current | One Year Ago | St. Louis | Chicago | San Francisco | Dallas |
| 3 | $50.00 | $42.50 | **$85.00** | $50.00 | ..... | $55.00 |
| 4 | 60.00 | 60.00 | **85.00** | 60.00 | $90.00 | 65.00 |
| 5 | 90.00 | 85.00 | **140.00** | 80.00 | 115.00 | 84.00 |
| 6 | 115.00 | 110.00 | **140.00** | 100.00 | 150.00 | 110.00 |
| 8 | 185.00 | 175.00 | **200.00** | 150.00 | 250.00 | 181.00 |

**SEWER PIPE**—The following prices are in cents per foot for carload lots:

| Size, In | New York Delivered | Pittsburgh | Birmingham | St. Louis | Chicago | San Francisco | Dallas |
|---|---|---|---|---|---|---|---|
| 3 | *$0.17* | $0.132 | ..... | **.125** | $0.135 | $0.13 | ..... |
| 4 | *.17* | .132 | $0.11 | **.125** | .135 | .1625 | $0.18 |
| 5 | *.26* | .198 | ..... | **.175** | .2025 | .195 | .165 |
| 6 | *.25* | .198 | .165 | **.175** | .2025 | .2275 | .25 |
| 8 | *.41* | .308 | .275 | **.250** | .315 | .325 | .35 |
| 10 | *.61* | .462 | .355 | **.350** | .4725 | .455 | ..... |
| 12 | *.78* | .594 | .4675 | **.450** | .6075 | .585 | .80 |
| 15 | *1.31* | .792 | .6875 | **.780** | .81 | .975 | ..... |
| 18 | *1.90* | 1.10 | .935 | **1.09** | 1.125 | 1.365 | ..... |
| 20 | *2.28* | 1.32 | 1.2375 | 1.15 | 1.35 | ..... | ..... |
| 22 | *3.04* | 1.98 | ..... | ..... | 1.80 | ..... | ..... |
| 24 | *3.42* | ..... | 1.7875 | **1.87** | 2.025 | 2.34 | 2.40 |
| 27 | ..... | ..... | ..... | **3.30** | 3.75 | 3.25 | ..... |
| 30 | ..... | ..... | 4.00 | **3.80** | 4.75 | 3.90 | ..... |
| 33 | ..... | ..... | ..... | **4.60** | 5.50 | ..... | ..... |
| 36 | ..... | ..... | ..... | **5.00** | 6.00 | ..... | ..... |

| | 3 | 5 | 8 | 12 | 24 | 36 |
|---|---|---|---|---|---|---|
| Boston | *$0.123* | *$0.185* | *$0.287* | *$0.554* | *$1.85* | *$4.98* |
| Minneapolis | ..... | ..... | .40 | .77 | **2.55** | 5.66 |
| Denver | ..... | .15 | .30 | .50 | 1.95 | ..... |
| Seattle | .145 | ..... | .36 | .72 | 2.59 | ..... |
| Los Angeles | .11* | .165* | .275 | *.485* | 1.65 | ..... |
| New Orleans | ..... | *.108* | *.266* | *.559* | *1.755* | ..... |
| Cincinnati | *.114* | *.171* | *.245* | *.513* | *1.710* | *4.61* |
| Atlanta | *.098** | *.147** | ..... | *.4165* | *1.5925* | ..... |
| Montreal, *delivered* | .30* | .45* | .85* | 1.35 | 4.50 | 6.50 |
| Detroit | .123 | .1845 | .287 | .5535 | 2.34 | 5.8425 |
| Baltimore | .13 | .198 | .31 | .595 | 2.00 | ..... |
| Baltimore, *delivered* | ..... | .28 | .44 | .86 | 2.84 | ..... |

*4-in., 6-in., 9-in., 30-in. respectively.

## ROAD AND PAVING MATERIALS

**ROAD OILS**—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

| | | Current | One Year Ago |
|---|---|---|---|
| New York, 45% asphalt | (at terminal) | *$0.06½* | $0.13 |
| New York, 65% asphalt | (at terminal) | *.05* | .13 |
| New York, binder | (at terminal) | *.06½* | .14 |
| New York, flux | (at terminal) | *.05½* | .15 |
| New York, liquid asphalt | (at terminal) | *.07* | .13 |
| St. Louis, 40-60% asphalt (*f.o.b.*) *Tulsa, Okla.* | | *.02½** | .10 |
| Chicago, 40-50% asphalt | | .06 | .08 |
| Chicago, 60-70% asphalt | | .06½ | .08½ |
| Dallas, 40-50% asphalt | | .10 | .07 |
| Dallas, 60-70% asphalt | | .13 | .08 |
| Dallas, 75-90% asphalt | | .15 | .10 |
| San Francisco, binder, per ton | | 15.00 | 13.00 |

* Freight $21.75 per ton to Whiting, Ind.

**ASPHALT**—Price per ton in packages (350-lb. bbl., or 425-lb. drums, and in bulk in carload lots:

| | Package | Bulk |
|---|---|---|
| New York (Bayonne, N. J.) | $24.00 | $15.00 |
| Boston | No quotation. | |
| Chicago | 28.50 | 21.00 |
| San Francisco, *f.o.b. refinery*, Oleum, Cal. | 21.50* | 15.00* |
| Dallas | 35.00 | 27.00 |
| Seattle | 27.50 | |
| Denver | .... | 50@70 |
| Minneapolis | ..... | 40.50 |
| St. Louis | sold out for 1921 | |
| Baltimore | 40.00 | |
| Los Angeles, *at factory* | 22.50 | 15.00 |
| Montreal | 28.00 | 21.00 |
| Atlanta | 31.50 | |
| Detroit (petroleum asphalt) | 24.50 | 20.00 |
| Cincinnati | 27.10 | 22.10 |
| Maurer, N. J. (asphalt) | 27@38 | .... |
| Maurer, N. J. (asphalt cement) | 29@36 | 25@31 |

*Freight to San Francisco, 80c. per ton.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums. Rebates of about $1 per bbl., no rebate for drums.

**PAVING STONE**—

| | | |
|---|---|---|
| New York | 5-in. granite, 28@29 blocks per sq.yd. | $130.00 per M |
| Chicago | About 4x8x4 dressed | 3.35 sq.yd. |
| | About 4x8x4 common | 3.00 sq.yd. |
| San Francisco | Basalt block 4x7x8 | 65.00 per M |
| Boston | 5-in. granite | 4.20 sq.yd. |
| Atlanta | Granite | 2.00 sq.yd. |
| Detroit | Granite, 20½ blocks per sq.yd. | 107.00 per M |
| Baltimore | Granite | 2.25 sq.yd. |
| Montreal | Granite | 130.00 per M |
| New Orleans | Granite, 4 x 8 x 4 | 3.25 sq.yd. |
| Cincinnati | Granite | 4.50 sq.yd. |
| St. Louis | 4x8x4 dressed | 3.35 sq.yd. |
| | 4x84x common | 3.00 sq.yd. |
| Kansas City | No. 1 Granite | 3.90@3.95 sq.yd. |

**FLAGGING**—

| | | | |
|---|---|---|---|
| New York | Bronx | $0.25 | sq.ft. |
| | Manhattan, 4 ft. | .26 | sq.ft. |
| | Queens, 5 ft. | .26 | sq.ft. |
| | 6x20-in. cross-walk | 1.00 | lin.ft. |
| Chicago | 18 in. wide | .70 | lin.ft. |

**CURBING**—Bluestone per lineal foot, in New York, costs 77c. for 5x16 in., 88c. for 5x18 in.; in cargo lots.

**WOOD BLOCK PAVING**—

| | Size of Block | Treatment | Per Sq.Yd. |
|---|---|---|---|
| New York | 3 | 16 | $2.27 |
| New York | 3½ | 16 | 2.49 |
| New York | 4 | 16 | 2.75 |
| Boston | 3 | 16 | 3.45 |
| Chicago | 4 | 16 | 3.75@4.00 |
| Chicago | 3½ | 16 | 3.25@3.50 |
| St. Louis | 3½ | 16 | 3.25 |
| St. Louis | 4 | 16 | 3.75 |
| Seattle | 4 | 16 | Off market |
| Minneapolis | 3½ | 16 | 2.37 |
| Atlanta | 3½ | 16 | 2.30 |
| New Orleans | 3 | 16 | 2.00 |
| New Orleans | 3½ | 16 | 2.35 |
| New Orleans | 4 | 16 | 2.65 |
| Dallas | 4 | 18 | 3.90 |
| Baltimore | 3½ | 16 | 3.75 |
| Montreal, *delivered* | 4 | 16 | 4.50 |
| Detroit | 3 | 16 | 2.84 |
| Detroit | 4 | 16 | 3.00 |
| Cincinnati | 4 | 16 | 3.30 |
| Kansas City | 4 | 16 | 2.35 |

# CONSTRUCTION MATERIALS

**SAND AND GRAVEL**—Price for cargo or carload lots is as follows, per cu.yd.:

| | Gravel 1½ In. Current | Gravel 1½ In. One Year Ago | Gravel ¾ In. Current | Gravel ¾ In. One Year Ago | Sand Current | Sand One Year Ago |
|---|---|---|---|---|---|---|
| New York | $2.25 | $3.00 | 2.25 | $3.00 | $1.25 | $1.50 |
| Denver | 2.00 | 1.40 | 1.80 | 1.80 | 1.60 | 1.00 |
| Chicago | 2.25 | 2.15 | 2.25 | 2.15 | 2.25 | 2.15 |
| St. Louis, *per ton* | 1.45 | 1.50‡ | 1.45 | 1.55 | 1.60* | 1.55 |
| Seattle | 1.50 | 1.25 | 1.50 | 1.25 | 1.50 | 1.25 |
| Dallas, *delivered* | 3.50 | 2.50 | 4.00 | 2.50 | 3.00 | 2.00 |
| Minneapolis, *at pit* | 2.00 | 2.00 | .... | 1.35 | 1.00 | 1.25 |
| Cincinnati | 2.25 | .... | 2.25 | 1.50 | 1.69 | 1.45 |
| San Francisco | 2.25 | 1.50 | 2.50 | 1.50 | 1.50 | 1.50 |
| Boston, per ton | 2.65 | 3.50 | 2.65 | 3.00 | 2.00 | 2.75 |
| New Orleans | 2.85 | 3.00 | .... | .... | 1.35 | 1.40 |
| Los Angeles, per ton | 1.45† | 1.25 | 1.45† | 1.25 | 1.30† | 1.15 |
| Atlanta, per ton | 2.35 | 2.25 | 2.25 | 2.25 | 1.35 | 1.15 |
| Detroit | 2.25 | 2.50 | 2.25 | 2.50 | 2.25 | 2.50 |
| Baltimore, per ton | 1.40 | 1.40 | 1.60 | 1.60 | .70 | .70 |
| Montreal, per ton | 1.50 | 1.45 | 1.50 | .... | 1.25 | 1.30 |
| Birmingham | .... | .... | .... | .... | 1.60 | 1.25 |

* Fine white sand: Pacific, $4 per ton; Ottawa, $4.50

† Freight from quarry to Los Angeles is 80c. per ton, and is included in above price.

‡ Per cu. yd.

**CRUSHED STONE**—Price for cargo or carload lots f.o.b. city, unless stated otherwise, is as follows, per cu.yd.:

| | 1½ In. Current | 1½ In. One Year Ago | ¾ In. Current | ¾ In. One Year Ago |
|---|---|---|---|---|
| New York | $1.90@2.00 | $1.90 | $1.90@2.00 | $2.15 |
| Chicago | 2.50 | 2.35 | 2.50 | 2.50 |
| St. Louis *delivered* | 1.60* | 1.90 | 1.60* | 1.90 |
| Dallas | 2.80 | 3.50 | 2.80 | 3.50 |
| San Francisco | 2.25 | 1.50 | 2.50 | 1.50 |
| Boston, *delivered* | 3.00* | 3.00 | 3.00* | 3.00 |
| Minneapolis, *at plant* | 2.00 | 2.25 | 2.25 | 2.50 |
| Kansas City† | 1.25 | 2.35 | 1.40 | 2.35 |
| Denver | .... | 3.75 | .... | 3.75 |
| Seattle *delivered* | 3.00 | 3.00 | 3.50 | 3.50 |
| Atlanta | 2.25* | 3.10 | .... | .... |
| Cincinnati *delivered* | 2.06 | .... | 2.06 | 1.65 |
| Los Angeles | .90* | 1.60 | 1.00 | 1.70 |
| Detroit | 2.00* | 2.00 | 2.00* | 2.00 |
| Baltimore | 1.75* | 1.60 | 1.75* | 2.00 |
| Montreal | 2.00* | 2.30 | 2.10* | 2.00 |
| Birmingham | 3.20 | .... | 3.10 | 2.55 |

*Per ton. †F.o.b. Joplin, Mo.

**CRUSHED SLAG**—Price of crushed slag in carload lots, per net ton, at plant:

| | 1½-In. | ¾-In. | Roofing | Sand |
|---|---|---|---|---|
| Lebanon or Bethlehem, Pa. | $1.00 | $1.00 | $2.50 | $0.90 |
| Easton or Catasaqua, Pa. | 1.00 | 1.00 | 2.00 | .90 |
| Buffalo, N. Y. and Erie, Pa. | 1.25 | 1.25 | 2.25 | 1.25 |
| Emporium, Pa. | 1.25 | 1.25 | .... | 1.25 |
| East Canaan, Conn. | 1.25 | 1.35 | 4.00 | 1.10 |
| Birmingham, Ala. | 1.05 | 1.15 | 2.05 | .... |
| Toledo, Ohio | 1.50 | 1.50 | 2.35 | .... |
| Atlanta, Ga. | .... | 2.10 | .... | 2.25 |
| Eastern Pennsylvania and New Jersey | 1.20 | 1.20 | 2.50 | .90 |
| Westrn Pennsylvania and New Jersey | 1.25 | 1.25 | 2.50 | 1.25 |

Birmingham, f.o.b. pit $1.15 (or $2.75 per cu. yd. on site)

**LIME**—Warehouse prices:

| | Hydrated, per Ton Finishing | Hydrated, per Ton Common | Lump, per 180-Lb. Barrel (net) Finishing | Lump, per 180-Lb. Barrel (net) Common |
|---|---|---|---|---|
| New York | $16.50 | $..... | $..... | $3.75* |
| Chicago | 20.00 | | .... | 1.75 |
| St. Louis | 24.00 | 20.00 | .... | 2.50* |
| Boston | 24.25 | 20.25 | 3.50† | 3.25 |
| Dallas | 27.50 | 25.00 | .... | 3.00† |
| Cincinnati | 16.70 | 14.50 | .... | 12.75‡ |
| San Francisco | 25.40 | 22.00 | .... | 2.25 |
| Minneapolis | 29.00 | 22.00 (white) | 2.00 | 1.80 |
| Denver | .... | 3.20 (bbl.) | 1.00 (bu.) | |
| Detroit | 22.00 | 19.00 | 2.00† | 1.80 |
| Seattle | 27.00 | .... | 3.50 | .... |
| Los Angeles | .... | 30.00 | 3.00* | 3.00 |
| Baltimore | 22.25 | 17.50 | .... | 12.75‡ |
| Montreal | 28.00 | .... | 15.00‡ | .... |
| Atlanta | 19.00 | 16.00 | 2.00 | 1.50 |
| New Orleans | .... | 37.50 | .... | 2.25 |

* 280-lb. barrels. † Per 180-lb. barrel. ‡ Per ton.

NOTE—Refund of 10c. per barrel.

**NATURAL CEMENT**—Price to dealers for 500 bbl. or over, f.o.b., exclusive of bags:

| | Current | One Year Ago |
|---|---|---|
| Minneapolis (Rosendale) | $2.80 | $1.50 |
| Kansas City (Ft. Scott) | 1.60 | 1.60 |
| New Orleans | 3.36 | 3.36 |
| Atlanta (Magnolia) | 11.00 ton | 1.90 |
| Cincinnati (Utica) | 1.87 | 2.85 |
| Boston (Rosendale) | 1.05@1.95 | 2.35 |

**PORTLAND CEMENT**—Current prices are for barrels in carload lots, *with* net bags, to contractors:

| | Current Without Bags | One Month Ago Without Bags | One Year Ago Without Bags |
|---|---|---|---|
| New York (delivered) | $2.60@2.70 | $2.80 | $4.10 |
| New York, alongside dock to dealers | 2.10 | 2.40 | 2.65 |
| Jersey City (delivered) | 2.89 | 2.89 | 3.22 |
| Boston | 2.86 | 2.86 | 3.32 |
| Chicago | 2.17 | 2.17 | 2.15 |
| Pittsburgh | 2.17 | 2.17 | 2.20 |
| Cleveland | 2.43 | 2.43 | 2.42 |
| Detroit | 2.43 | 2.43 | 3.00 |
| Indianapolis | 2.43 | 2.43 | 2.42 |
| Toledo | 2.49 | 2.49 | 2.28 |
| Milwaukee | 2.39 | 2.39 | 2.20 |
| Duluth | 2.10 | 2.10 | 2.20 |
| Peoria | 2.45 | 2.45 | 2.32 |
| Cedar Rapids | 2.51 | 2.51 | 2.40 |
| Davenport | 2.47 | 2.47 | 2.36 |
| St. Louis | 2.90 | 3.00 | 2.85 |
| San Francisco | 3.09 | 3.09 | 2.88 |
| New Orleans | 3.20 | 3.36 | 3.24 |
| Minneapolis | 2.41 | 2.41 | 2.42 |
| Denver | 3.10 | 3.10 | 3.80 |
| Seattle | 3.10 | 3.10 | 3.03 |
| Dallas | 2.60 | 2.60 | 2.15 |
| Atlanta | 2.75 | 2.60 | 2.70 |
| Cincinnati | 2.62 | 2.62 | 2.85 |
| Los Angeles | 3.21 | 3.31 | 3.10 |
| Baltimore (del.) drayload lots | 3.58 | 2.58 | 3.28 |
| Detroit | 2.43 | 2.43 | 4.00 |
| Birmingham | 3.05 | 3.05 | |
| Kansas City | 3.20 | 3.20 | 2.76 |
| Montreal | 2.75 | 2.95 | 2.95 |

NOTE—Bags 10c. each, 40c. per bbl.; 80c. per bbl. in Montreal.

**TRIANGLE MESH**—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH by 4-INCH MESH

| Style Number | Weight in Pounds | Pittsburgh, Mill | New York (Warehouse) | Chicago | Dallas | San Francisco |
|---|---|---|---|---|---|---|
| 032 | 0.022 | $0.74 | 1.16 | .... | $1.15 | $1.24 |
| 049 | 0.028 | 0.94 | 1.45 | .... | 1.46 | 1.56 |
| 068 | 0.035 | 1.14 | 1.74 | .... | 1.80 | 1.92 |
| 093 | 0.045 | 1.46 | 2.20 | .... | 2.30 | 2.46 |
| 126 | 0.057 | 1.80 | 2.69 | .... | 2.86 | 3.07 |
| 153 | 0.068 | 2.14 | 3.18 | .... | 3.40 | .... |
| 180 | 0.078 | 2.46 | 3.63 | .... | 3.93 | .... |
| 245 | 0.103 | 3.24 | 4.74 | .... | 5.15 | .... |
| 287 | 0.119 | 3.75 | 5.46 | .... | 5.96 | 6.41 |
| 336 | 0.138 | 4.35 | 6.33 | .... | 7.32 | .... |
| 395 | 0.160 | 5.04 | 7.30 | .... | 8.00 | .... |
| | | PAVING | | | | |
| 036P | 0.017 | $0.56 | .... | .... | $0.88 | .... |
| 053P | 0.024 | 0.79 | .... | .... | 1.24 | .... |
| 072P | 0.031 | 0.99 | .... | .... | 1.57 | .... |
| 097P | 0.040 | 1.28 | .... | .... | 2.02 | .... |
| 049R | 0.024 | 0.79 | .... | .... | 1.24 | .... |
| 067R | 0.031 | 0.99 | .... | .... | 1.57 | .... |
| 089R | 0.040 | 1.28 | .... | .... | 2.02 | .... |

Made in 16-, 20-, 24-, 28-, 32-, 36-, 40-, 44-, 48-, 52- and 56-in. width in rolls 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher.

**EXPANDED METAL LATH**—Prices in carload lots per 100 yd. for painted are as follows:

| Gage | Weight | *New York | Chicago | St. Louis | San Francisco | Dallas |
|---|---|---|---|---|---|---|
| 27 | 233 | $23.25 | $27.50 | $27.60 | $34.20 | $31.55 |
| 26 | 250 | 24.65 | 28.90 | 28.90 | 28.75 | 33.30 |
| 25 | 300 | 27.30 | 31.15 | 31.15 | ..... | 36.00 |
| 24 | 340 | 29.10 | 33.10 | 33.10 | 33.06 | 37.45 |
| 22 | 433 | 33.80 | ..... | ..... | ..... | 43.30 |

*Material shipped from mill, freight allowed, or at warehouse. Delivery charge is 1c. per sq. yd.

**BARS, CONCRETE REINFORCING**—Current quotations per 100 lb:

ROLLED FROM BILLETS

| Inches | Pittsburgh Mill | Warehouse, Uncut: New York | Birmingham Mill | Chicago | St. Louis | Dallas | San Francisco |
|---|---|---|---|---|---|---|---|
| ¼ and larger | $2.10 | $2.93 | $2.75 | $3.13 | $3.02 | $3.75 | $2.35 |
| ⅜ and larger | 2.15 | 2.98 | 3.10 | 3.17 | 3.07 | 3.80 | 2.40 |
| ½ and larger | 2.20 | 3.03 | 3.10 | 3.23 | 3.12 | 3.85 | 2.45 |
| ⅝ and larger | 2.35 | 3.08 | 3.10 | 3.38 | 3.27 | 4.00 | 2.60 |
| ¾ and larger | 2.60 | 3.13 | 3.10 | 3.83 | 3.52 | 4.45 | 2.85 |

*Includes 15c charge for cutting to lengths of 2 ft. and over.
Twisted bars cut to length take extra of 27½c. per 100 lb.

ROLLED FROM RAILS

| | Chicago | St. Louis | Dallas | | Chicago | St. Louis | Dallas |
|---|---|---|---|---|---|---|---|
| ¼ in. and larger | $2.00 | $2.00 | $4.25 | ½ | $2.40 | $2.25 | $3.40 |
| ⅜ | 2.05 | 2.05 | 4.30 | ⅝ | 2.40 | 2.50 | 3.45 |
| ½ | 2.15 | 2.10 | .... | ¾ | .... | .... | 3.50 |

**BRICK**—Contractors price per 1,000 in cargo or carload lots is as follows:

| | Common: Current | One Month Ago | One Year Ago | —Paving Block— 3-inch* | 4-inch* |
|---|---|---|---|---|---|
| New York (del.) | $18.40 | $18.40 | $33.00 | $47.00 | $42.50 |
| New York (at dock) | 15@15.50 | 15.50 | 25.00 | ..... | ..... |
| Chicago | 12.00 | 12.00 | 16.00 | 34.00 | ..... |
| St. Louis, salmon | 17.00 | 17.00 | 16.00 | ..... | ..... |
| Denver, salmon | 14.00 | 14.00 | 17.00 | ..... | ..... |
| Dallas | 12.50 | 12.50 | 24.00 | 44.00 | ..... |
| San Francisco | 18.00 | 18.00 | 18.00 | ..... | 44.38 |
| Los Angeles | 15.56 | 15.50 | 13.50 | (not used) | |
| Boston (del.) | 18.00 | 20.00 | 32.00 | 46.00 | 56.25 |
| Minneapolis (del.) | 17.00 | 17.00 | 24@26 | 37.00 | 43.00 |
| Kansas City | 15.50 | 15.50 | 22.00 | ..... | ..... |
| Seattle | 14.00 | 14.00 | 15.00 | 48.00 | 53.50 |
| Cincinnati | 19.00 | 18@20 | 24.00 | 41.00 | ..... |
| Montreal (del.) | 18.00 | 18.00 | 16.00 | 100.00 | 120.00 |
| Detroit (del.) | 16.25@18 | 16.25@18 | 23.00 | 41.30 | 44.00 |
| Baltimore (del.) | 25.00 | 25.00 | 20@25 | 40.00‡ | 44.00‡ |
| Atlanta | 10.00 | 11.00 | ..... | 40.00 | ..... |
| New Orleans | 14.50 | 14.50 | 25.00 | ..... | ..... |
| Birmingham | 12.00 | ..... | ..... | ..... | ..... |

* For paving blocks 3½x8½x3 and 3½x8½x4 respectively. ‡ Vitrified, f.o.b. plant, Baltimore.

**HOLLOW TILE**—Price per block in carload lots for hollow building tile:

| | New York: Current on Trucks* | New York: One Year Ago | Chicago | St. Louis: building | St. Louis: partition | San Francisco | Perth Amboy N. J., Factory |
|---|---|---|---|---|---|---|---|
| 4x12x12 | $0.12320 | ..... | $0.09475 | ..... | $0.090 | $0.145 | $..... |
| 6x12x12 | .16420 | ..... | .13740 | ..... | .121 | .21 | ..... |
| 8x12x12 | .219 | ..... | .16105 | ..... | .165 | .29 | .2084 |
| 10x12x12 | ..... | ..... | .19790 | ..... | .218 | ..... | .2605 |
| 12x12x12 | ..... | ..... | .23750 | ..... | .250 | ..... | .3126 |

*5 per. off for cash

| | 4x12x12 | 8x12x12 | 12x12x12 |
|---|---|---|---|
| Boston | $0.105 | $0.198 | $.277 |
| Minneapolis | .084 | .161 | .230 |
| Minneapolis (delivered) | .092 | .175 | .250 |
| Cincinnati | .07425 | .1254 | .1848 |
| Kansas City | .115 | .207 | ..... |
| Denver | .09 | .16 | .23 |
| Seattle | .10 | .175 | .30 |
| Los Angeles factory | .11 | .192 | .23* |
| New Orleans | .14 | .25 | .42 |
| Detroit (delivered) | .107 | .250 | .2776 |
| Montreal | .20 | .30 | .35 |
| Baltimore | .16 | .27 | .45 |
| Atlanta | .0765 | .136 | ..... |
| Dallas | .13 | ..... | ..... |
| Birmingham | .11 | .18 | ..... |

**STRUCTURAL MATERIAL**—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

| | Pittsburgh, Mill | New York (del.) | Birmingham | Dallas | St. Louis | Chicago (del.) | San Francisco |
|---|---|---|---|---|---|---|---|
| Beams, 3 to 15 in. | 1.85 | $2.88 | $2.76 | $4.50 | $3.12½ | $2.88 | $4.15 |
| Channel, 3 to 15 in. | 1.85 | 2.88 | 2.76 | 4.50 | 3.12½ | 2.88 | 4.15 |
| Angles, 3 to 6 in., ¼ in. thick | 1.85 | 2.88 | 2.76 | 4.50 | 3.12½ | 2.88 | 4.26 |
| Tees, 3 in. and larger | 1.85 | 2.88 | 2.76 | 4.50 | 3.12½ | 2.88 | 4.26 |
| Plates | 1.85 | 2.88 | 2.76 | 4.50 | 3.32½ | 2.88 | 4.26 |

**RIVETS**—The following quotations are per 100 lb.:

STRUCTURAL

| | Warehouse: Pittsburgh, Mill | New York: Current | New York: One Yr. Ago | Chicago | St. Louis | San Francisco | Dallas |
|---|---|---|---|---|---|---|---|
| ½ in. and larger | $2.65 | $4.40 | $6.00 | $4.53 | $4.12½ | $5.80 | $5.75 |

CONE HEAD BOILER

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ½ in. and larger | 2.75 | 4.50 | 7.10 | 4.63 | 4.22½ | 6.10 | 5.90 |
| ⅝ and ¾ | 2.90 | 4.65 | 7.25 | 4.78 | 4.22½ | 6.35 | 6.05 |
| ⅞ and 1 | 3.15 | 4.90 | 7.50 | 5.03 | 4.22½ | 6.60 | 6.30 |

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in take an extra of 25c.

**NAILS**—The following quotations are per keg from warehouse:

| | Pittsburgh, Mill | Chicago | San Francisco | Dallas | St. Louis | Montreal |
|---|---|---|---|---|---|---|
| Wire | $2.75@$3.00 | $3.78 | $5.00 | $5.00 | $3.48 | $4.95 |
| Cut | 3.00@ 3.25 | 6.85 | 6.28 | 7.75 | 4.08 | 5.00 |

**PREPARED ROOFINGS**—Standard grade rubbered surface, complete with nails and cement, costs per square as follows at manufacturing points:

| | New York: 1-Ply l.c.l. | New York: 2-Ply l.c.l. | New York: 3-Ply l.c.l. | Philadelphia: 1-Ply l.c.l. | Philadelphia: 2-Ply l.c.l. | Philadelphia: 3-Ply l.c.l. |
|---|---|---|---|---|---|---|
| No. 1 grade | $2.07 | $2.43 | $2.85 | $1.97 | $2.33 | $2.75 |
| No. 2 grade | 1.77 | 2.08 | 2.45 | 1.67 | 1.93 | 2.35 |

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.80 per roll in carload lots and $3.05 for smaller quantities f.o.b. Philadelphia.
Shingles, red and green slate finish, cost $7.95 per square in carloads; $8.20 in smaller quantities, in Philadelphia.

**ROOFING MATERIALS**—Prices per ton f.o.b. New York:

| | |
|---|---|
| Tar felt (14 lb. per square of 100 sq.ft.) per roll of 432 sq. ft | $2.60 |
| Tar pitch (in 400-lb. bbl.) per 100 lb | 1.95 |
| Asphalt pitch (in barrels) per ton | 47.50 |
| Asphalt felt (light) per ton | 80.50 |
| Asphalt felt (heavy) per ton | 84.50 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse also the base quotations from mill:

| Blue Annealed | Pittsburgh, Large Mill Lots | St. Louis | Chicago | San Francisco | New York |
|---|---|---|---|---|---|
| No. 10 | $3.10 | $3.77½ | $3.88 | $5.50 | $3.53 |
| No. 12 | 3.15 | 3.82½ | 3.98 | 5.55 | 4.43 |
| No. 14 | 3.20 | 3.87½ | 4.08 | 5.60 | 4.48 |
| No. 16 | 3.30 | 4.17½ | 4.18 | 5.70 | 4.58 |
| **Black** | | | | | |
| *Nos. 18 and 20 | 3.85 | 4.80 | 4.95 | 6.30 | 4.05 |
| *Nos. 22 and 24 | 3.90 | 4.85 | 5.00 | 6.35 | 4.10 |
| *No. 26 | 3.95 | 4.90 | 5.05 | 6.40 | 4.15 |
| *No. 28 | 4.00 | 5.00 | 5.15 | 6.50 | 4.25 |
| **Galvanized** | | | | | |
| No. 10 | 4.00 | 5.00 | 5.45 | ..... | 4.10 |
| No. 12 | 4.10 | 5.10 | 5.55 | 6.60 | 4.20 |
| No. 14 | 4.25 | 5.10 | 5.55 | 6.60 | 4.35 |
| Nos. 17 to 21 | 4.40 | 5.40 | 5.85 | 6.90 | 4.65 |
| Nos. 22 and 24 | 4.55 | 5.55 | 6.00 | 7.05 | 4.80 |
| *Nos. 25 and 26 | 4.70 | 5.70 | 6.30 | 7.20 | 4.95 |
| *No. 28 | 5.00 | 6.00 | 6.40 | 7.50 | 5.25 |

* For painted corrugated sheets add 30c. per 1000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

**LINSEED OIL**—These prices are per gallon:

| | New York: Current | New York: One Year Ago | Chicago: Current | Chicago: One Year Ago |
|---|---|---|---|---|
| Raw in barrel (5 bbl.) | $0.80 | $1.53 | $0.75 | $1.95 |

**WHITE AND RED LEAD**—Base price per pound:

| | Red — Current | | Red — 1 Year Ago | | White — Current | White — 1 Yr. Ago |
|---|---|---|---|---|---|---|
| | Dry | In Oil | Dry | In Oil | Dry and In Oil | Dry and In Oil |
| 100-lb. keg | 13.00 | 14.50 | 15.50 | 17.00 | 13.00 | 15.50 |
| 25 and 50-lb. kegs | 13.25 | 14.75 | 15.75 | 17.25 | 13.25 | 15.75 |
| 12½-lb. keg | 13.50 | 15.00 | 16.00 | 17.50 | 13.50 | 16.00 |
| 5-lb. cans | 16.00 | 17.50 | 18.50 | 20.00 | 16.00 | 18.50 |
| 1-lb. cans | 18.00 | 19.50 | 20.50 | 22.00 | 18.00 | 20.50 |

## LUMBER

**San Francisco**—Prices of rough Douglas fir No. 1 common, in more than carload lots:

| | Lumber Prices in Yards at San Francisco: 6-8 and 12 Ft. | 10-16-18 and 20 Ft. | 22 and 24 Ft. | 25 to 32 Ft. |
|---|---|---|---|---|
| 3x3 and 4 | $24.50 | $25.00 | $26.00 | $28.00 |
| 3x6 and 8 | 25.50 | 26.00 | 27.00 | 29.00 |
| 4x4-6 and 8 | 26.00 | 27.00 | 28.00 | 29.50 |
| 3x10 and 12 | 26.00 | 27.00 | 28.00 | 30.00 |
| 3x14 | 26.50 | 27.50 | 28.50 | 30.50 |
| 4x10 and 12 | 26.00 | 27.00 | 28.00 | 30.00 |
| 4x14 | 27.00 | 28.00 | 29.00 | 31.00 |

| | 24 Ft. and Under | 25 to 32 Ft. | 33 to 40 Ft. |
|---|---|---|---|
| 4x10 | $25.50 | $27.50 | $28.50 |
| 6x14 | 27.00 | 29.00 | 29.50 |
| 8x10 | 25.50 | 27.50 | 28.50 |
| 3x14 | 27.00 | 29.00 | 29.50 |

**New York, Chicago and St. Louis**

| | Southern Pine — New York* — 20 Ft. and Under | New York* — 22-24 Ft. | Chicago — 20 Ft. and Under | Chicago — 22-24 Ft. |
|---|---|---|---|---|
| 3x 4 to 8x8 | $33.00 | $34.00 | $50.00 | $51.00 |
| 3x10 to 10x10 | 38.00 | 39.00 | 53.00 | 53.00 |
| 3x12 to 12x12 | 43.00 | 44.00 | 54.00 | 55.00 |
| 3x14 to 14x14 | 48.00 | 49.00 | 59.00 | 60.00 |
| 3x16 to 16x16 | 55.00 | 56.00 | 64.00 | 65.00 |
| 3x18 to 18x18 | 67.00 | 68.00 | 69.00 | 69.00 |
| 4x20 to 20x20 | ..... | ..... | 71.00 | 72.00 |

*Wholesale price (to dealers) of long leaf pine. Short leaf pine up to 14 x 14 costs $15 per M. less.

Price to contractors, on lighters or cars, New York, about $5 additional.

**St. Louis:** Yellow pine, 22@24 ft. long, 3 x 4 to 4 x 4, $34.50; 3 x 6 to 8 x 8, $33; 3 x 12 to 5 x 12, $40; 3 x 14 to 4 x 14, $46; 3 x 16 to 4 x 16, $51; 3 x 18 to 5 x 18, $58:

**Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12x12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under. For pine add $2 to the price of merchantable for all sizes.**

**Other Cities**

| | 8 x 8-In. x 20-Ft. and Under — P. | Fir | Hemlock | Spruce | 12 x 12-In. 20 Ft. and Under — P. | Fir |
|---|---|---|---|---|---|---|
| Boston | $45.00 | $52.00 | $55.00 | $45.00 | $55.00 | $52.00 |
| Seattle | ..... | 15.00 | ..... | ..... | ..... | 17.00 |
| New Orleans | 26.00 | 25.00 | ..... | ..... | 31.00 | 27.00 |
| Baltimore | 58.00 | ..... | ..... | ..... | 68.00 | ..... |
| Cincinnati | 30.00 | 50.00 | ..... | ..... | 30.00 | 64.00 |
| Montreal | 70.00 | 85.00 | 68.00 | 78.00 | 78.00 | 100.00 |
| Los Angeles | ..... | 83.00 | 82.00 | ..... | ..... | 88.00 |
| Detroit | Quotations f.o.b mills only | | | | | |
| Denver | ..... | 31.75 | ..... | ..... | ..... | 32.75 |
| Minneapolis | 42.00 | 36.00 | 31.00 | ..... | 49.00 | 36.00 |
| Atlanta | 27.50 | ..... | ..... | ..... | 39.00 | ..... |
| Dallas | 35.00 | ..... | ..... | ..... | 49.00 | ..... |
| Kansas City | 34.00 | 35.00 | ..... | ..... | 39.00 | 37.00 |
| Birmingham | 30.00 | ..... | ..... | ..... | 38.00 | ..... |

| | 1-In. Rough, 10 In. x 16 Ft. and Under — P. | Fir | Hemlock | 2-In. T. and Gr. 10 In. x 16 Ft. — P. | Fir |
|---|---|---|---|---|---|
| Boston | $45.00 | $48.00 | $37.00 | $43.00 | $48.00 |
| Seattle | ..... | 20.00 | ..... | ..... | 20.00 |
| New Orleans, at mill | 50.00 | 25.00 | ..... | 30.00 | ..... |
| Baltimore | 42.50 | ..... | ..... | 40.00 | ..... |
| Cincinnati | 52.00 | 80.00 | ..... | 27.00 | ..... |
| Montreal | 120.00 | 60.00 | 60.00 | 80.00 | 80.00 |
| Los Angeles | ..... | 41.00 | 40.00 | ..... | 78.00 |
| Denver | ..... | 29.75 | ..... | ..... | 27.75 |
| Minneapolis | 38.00 | 31.25 | 31.25 | 36.00 | 29.25 |
| Atlanta | 15.00 | ..... | ..... | 18.00 | ..... |
| Dallas | ..... | 30.00 | ..... | 35.00 | ..... |
| Kansas City | 36.00 | 30.00 | ..... | ..... | 31.00 |
| Birmingham | 18.00 | ..... | ..... | ..... | ..... |

* Montreal—Up to 32 ft.; over which, $3.00 per M. increase up to 50 ft.

Birmingham—Dimension and form lumber delivered on building site, $26@$28. For 8x8x20 and smaller, 85 per cent heart, $33; 12x12x20 and smaller, 85 per cent heart, $42; 1x10x16 and smaller, rough, $16; 2x10x16 t. and g., $22; f.o.b. mill.

Detroit—General quotations not available. Rough fir, 2 x 12 and 2 x 4, by 16 ft., $44; 3 x 12 x 16 ft., $48; 2 x 4 x 16, $42.

## FREIGHT RATES

On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

| | | | |
|---|---|---|---|
| Baltimore | $0.33½ | Detroit | $0.33 |
| Birmingham | .76½ | Kansas City | .81½ |
| Boston | .41½ | New Orleans | .51½ |
| Buffalo | .29½ | New York | .38 |
| Chicago | .38 | Pacific Coast (all rail) | 1.66½† |
| Cincinnati | .33 | Philadelphia | .35 |
| Cleveland | .24 | St. Louis | .47½ |
| Denver | 1.35* | St. Paul | .69½ |

**Note—Add 3% transportation tax. * Minimum carload, 40,000 lb. Minimum carload, 50,000 lb., structural steel only; 80,000 lb. for other iron or steel products.**

## CONTRACTORS' SUPPLIES

**STEEL SHEETPILING**—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

| Current | One Month Ago | One Year Ago |
|---|---|---|
| $2.00 | $2.55 | $2.55@$3.65 |

**WIRE ROPE**—Discounts from list price on regular grades of bright and galvanized are as follows:

| | New York |
|---|---|
| Hercules red strand, all constructions | 55% |
| Patent flattened strand, special and cast steel | 45% |
| Patent flattened strand, iron rope | 50% |
| Plow steel round strand rope | 50% |
| Special steel round strand rope | 45% |
| Cast steel round strand rope | 50% |
| Iron strand and iron tiller | 10% |
| Galvanized iron rigging and guy rope | +5% |

San Francisco: Galvanized iron rigging and guy ropes +12½%; bright plow, 30% off.

Chicago: Plow steel, round strand, 30% off; flattened strand, 15%; cast steel, round strand, 17½%.

Western and California territory, 35% plow steel; +12½% galvanized iron rigging and guy rope.

Montana, Idaho and Arizona, 30% plow steel; +17½% galvanized iron rigging and guy rope.

**MANILA ROPE**—For rope smaller than ¾-in. the price is ½ to 2c. extra, while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¼-in., 8 ft.; ⅜-in., 6; ½-in., 4½; ⅝-in., 3½; ¾-in., 2 ft. 10 in.; 1-in., 2 ft. 4 in. Following is price per pound for ½-in. and larger, in 1200-ft. coils:

| | | | |
|---|---|---|---|
| Boston | $0.18 | New Orleans | .16 |
| New York | .16½ | Los Angeles | .14½* |
| Chicago | .18 | Seattle | .16 |
| Minneapolis | .17½ | St. Louis | .16½ |
| San Francisco | .15 | Montreal | .30 |
| Atlanta | .1950 | Detroit | .18 |
| Denver | .19 | Baltimore | .25 |
| Cincinnati | .17 | Kansas City | .16½ |
| Dallas | .29 | Birmingham | .20½ |

*780-ft. coils.

**EXPLOSIVES**—Price per pound of dynamite in small lots:

| | Gelatin 40% | Gelatin 60% |
|---|---|---|
| New York | $0.31 | $0.345 |
| Boston | .24 | .275 |
| Kansas City | .2425 | .2925 |
| Seattle | .20 | .235 |
| Chicago | .2425 | .2675 |
| Minneapolis | .2299 | .2555 |
| St. Louis | .28 | .315 |
| Denver | .2375 | .2725 |
| Dallas | .29 | .375 |
| Los Angeles | .25 | .29 |
| Atlanta | .27 | .305 |
| Baltimore | .2875 | .3175 |
| Cincinnati | .25 | .2750 |
| Montreal | .2150 | .2550 |
| Birmingham, *delivered* | .1925 | .2275 |
| New Orleans | .2725 | .3075 |

**PILES**—For spruce and plain pine piles, delivered New York, the price is as follows:

| | |
|---|---|
| Spruce 10-in. butts, 5-in. tops, length 20-30 ft | $11.50 |
| Spruce 12-in. butts, 6-in. tops, length 30-40 ft | 10.50 |
| Pine 12-in. butts, 6-in. tops, length 41-50 ft | 12.00 |
| Pine 14-in. butts, 6-in. tops, length 51-60 ft | 16.50 |
| Pine 14-in. butts, 6-in. tops, length 61-71 ft | 21.00 |

| | Dallas | | St. Louis |
|---|---|---|---|
| 6-in. x 20-ft | $4.60 | 6-in. x 30-ft | $7.90 |
| | | 7-in. x 30-ft | 10.10 |
| 6-in. x 30-ft | 7.10 | 7-in. x 35-ft | 15.55 |
| | | 8-in. x 35-ft | 16.55 |
| 8-in. x 30-ft | 8.45 | 7-in. x 40-ft | 16.05 |
| | | 8-in. x 45-ft | 27.05 |
| 8-in. x 35-ft | 10.38 | 8-in. x 50-ft | 28.05 |

**SCRAP—The prices following are per gross ton paid to dealers and producers in New York. In Chicago and St. Louis the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.**

| | New York | Chicago | St. Louis |
|---|---|---|---|
| No. 1 railroad wrought | $10.50 | $11.00 | $11.00 |
| Stove plate | 9.50 | 14.00 | 11.50 |
| No. 1 machinery cast | 17.50 | 15.00 | 14.00 |
| Machine shop turnings | 3.00 | 4.00 | 5.00 |
| Cast borings | 3.75 | 6.00 | 7.00 |
| Railroad malleable cast | 8.50 | 14.00 | 12.50 |
| Re-rolling rails | 10.00 | 13.00 | 12.00 |
| Relaying rails | 40.00 | 30.00 | 27.00 |

**SHIP SPIKES—Current prices per 100 lb.**

| In. | San Francisco — Galv. | San Francisco — Black | Seattle Black |
|---|---|---|---|
| ½ | $9.10 | $8.40 | $8.55 |
| ⅝ | 8.65 | 6.65 | 8.25 |
| ¾ | 8.50 | 6.50 | 8.30 |

**Pittsburgh base, $3.25@$3.40 per 100 lb.**